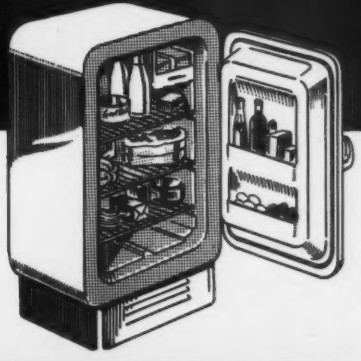
Plastics

DEALING WITH THE MANUFACTURE, USES AND POTENTIALITIES OF PLASTIC MATERIALS

Refrigerator Liner – vacuum formed by the 'Formvac Airslip' technique developed by Messrs. Hydro-Chemie. using Erinoid extruded high impact polystyrene sheeting, grade CP.20X, with high gloss finish on one side, Thickness .125.

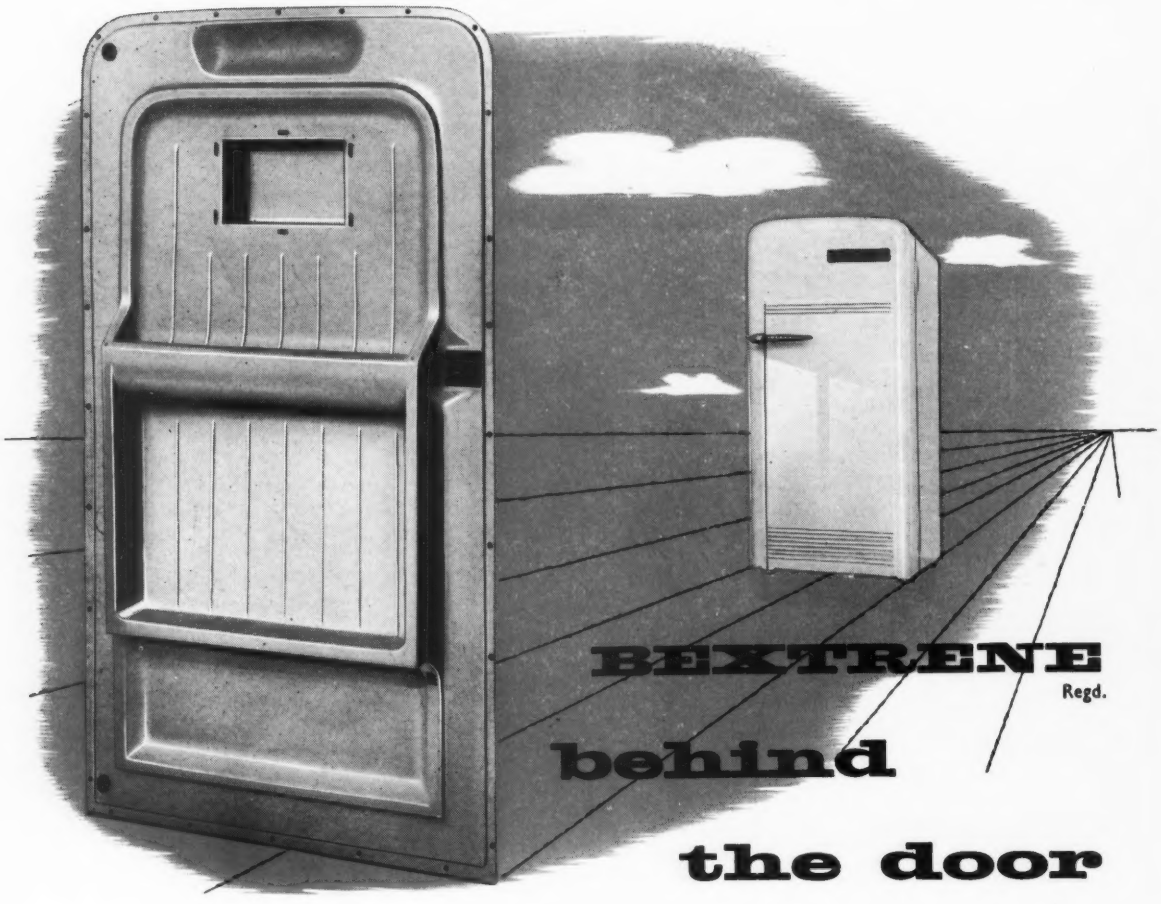
Dimensions of moulding 18 x 33 x 12½



Erinoid

Styrene Copolymer Sheeting

ERINOID LIMITED • STROUD • GLOUCESTERSHIRE



BEXTRENE SHEET brings new qualities to British Industry. Extruded from granules of BC15 toughened polystyrene made in our own factory, it is more than *four times* as tough as general purpose polystyrene, and is an excellent moulding sheet—for pressure moulding, vacuum forming or embossing—with high impact strength and dimensional stability. Its chemical resistance is good, it gives a fine finish, and is most economical to use.

BEXTRENE SHEET

BEXTRENE'S many applications include semi-rigid packaging containers of all kinds, display material and showcards, toys and games, etc. Refrigerator parts—where economy and toughness are specially important—are now being made from BEXTRENE SHEET, as witness this door liner vacuum formed by Thermoplastics Limited for Nash-Kelvinator Ltd.

(Write for a copy of Publication No. 566)

BX PLASTICS LTD

A Subsidiary of The British Xylonite Company Ltd.

Higham Station Avenue, London, E.4

Telephone: LARkswood 5511

Tullis Russell & Co. Ltd.

PAPERMAKERS SINCE 1809

GOOD NEWS FOR PRICE'S CUSTOMERS!

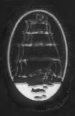
SECOND EMERSOL PLANT BOOSTS PRODUCTION

Bigger output of HIGH-GRADE Oleines and Stearines

FULL QUALITY CONTROL

Now Price's *two* Emersol plants—the last word in modern flow production—are in full commercial operation. This means that output of high-grade Oleines and Stearines is substantially increased. And, because this method of manufacturing is fully automatic, strict quality control can be maintained throughout the entire process. The result is that more Oleines and Stearines coming off the production line are of very high quality. You benefit from these greatly improved standards. For further information write to the address below.

AT YOUR SERVICE Our sales representatives and technical sales service department are at your disposal to discuss your particular requirements, and any problems that may arise.



PRICE'S (BROMBOROUGH) LIMITED

Daniels 250-Ton LOW Pressure Press

DANIELS
PRESSES AND ACCESSORIES
for
- COMPRESSION MOULDING
- HOBBING
- VACUUM FORMING

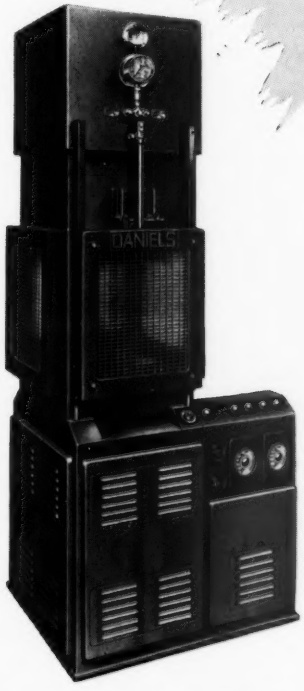
T. H. & J. Daniels Ltd., Stroud, through their long association with the design and manufacture of compression moulding presses, are able to offer the Plastics Industry a wide range of presses including Upstroke up to 250 tons; Downstroke and Transfer up to 500 tons; Side Ram up to 250 tons; Low-pressure, five sizes 12, 30, 50, 100 and 250 tons; Hobbing, two sizes 500 and 1,000 tons.

Many hundreds of these presses are in use in this country and abroad producing a wide variety of components, many of which demand a high degree of accuracy and finish.

Daniels also offer a Vacuum Forming Machine for straight vacuum or combined vacuum and drape forming.

A general catalogue giving full details of the entire range of Daniels Presses is available and will be sent on request.

We also offer a complete range of Injection Moulding Machines with moulding capacities ranging from 1½ oz. up to 22 oz.



Daniels 20-Ton Alkyd Moulding Press

Daniels/Latymer Junior Automatic Vacuum Forming Machine

SOLE AGENTS IN GREAT BRITAIN

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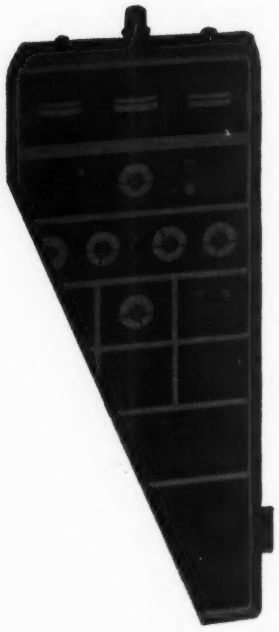

'PECO' from every angle

MOULDINGS PRODUCED ON
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CAPACITIES
8/oz
24/oz
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160/oz
ARE 'TOP' QUALITY STRAIN FREE

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INJECTION MOULDING
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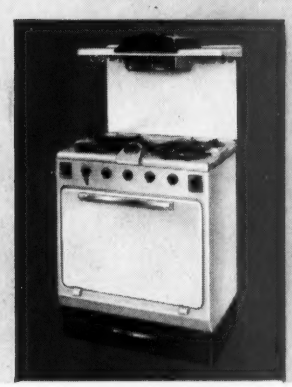
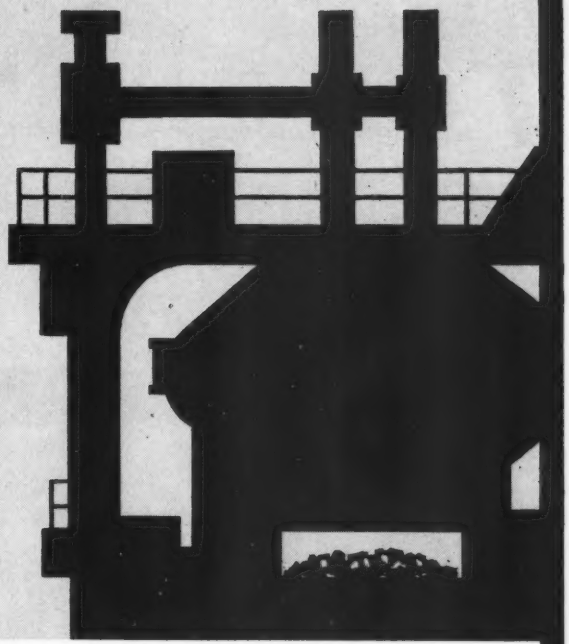
PECO PRODUCTS

IN COOKERS... IN BLAST FURNACES...

there's a job for

I.C.I. Silicone Rubbers





The hotplate on this Warwick luxury gas cooker, made by Thomas de la Rue & Co. Ltd., lifts to allow easy access to the burners. On the metal prop which supports the raised hot-plate is a small end cap of I.C.I. silicone rubber, moulded by the Dunlop Rubber Company. This cap protects the enamelled surface of the cooker—and is unaffected by the heat which would quickly destroy ordinary rubber.

From the small to the large... In many modern blast furnaces, I.C.I. silicone rubbers are used in wiring that is subjected to high temperature. An ideal application, because I.C.I. silicone rubbers withstand temperatures in excess of 250°C., maintain perfect insulation long after other materials have failed.

I.C.I. SILICONE RUBBERS —material progress

IMPERIAL CHEMICAL INDUSTRIES LIMITED, LONDON, S.W.1

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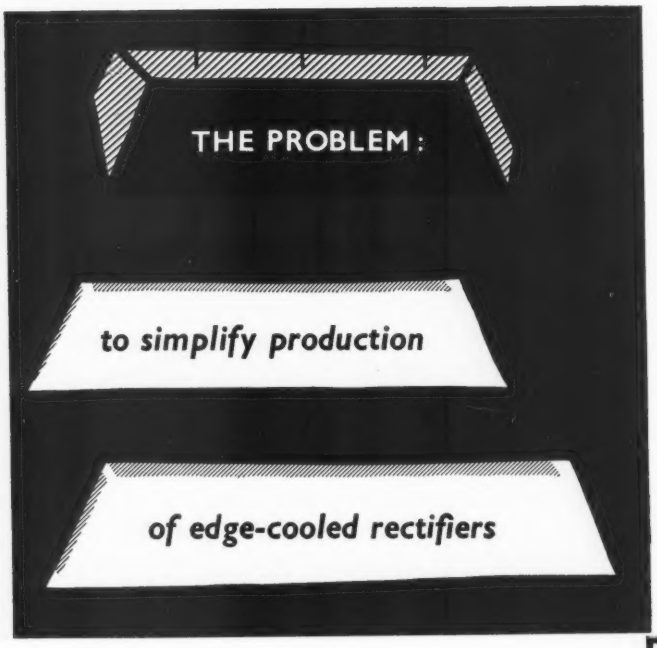
N.S.43



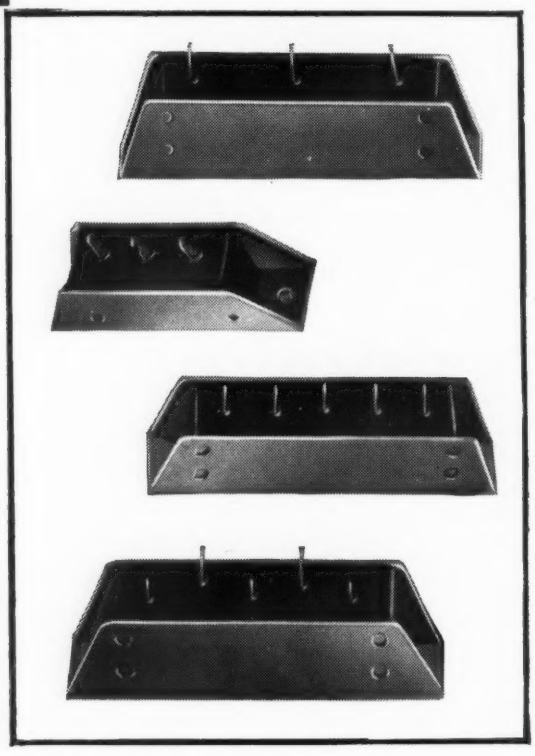
The main features of these Westinghouse high-temperature selenium rectifiers are their very effective cooling by a new edge conduction principle, their lightness and their exceptional compactness. Used in radio and television, they can work at full load at 100°C. This alliance of high performance, compactness and simple construction raised a number of design and production problems, which the Westinghouse Brake & Signal Co. Ltd. solved by the use of Epikote Resins as potting agents.

THE ANSWER:

potting in Epikote Resins

Epikote Resins, developed by Shell, possess all the properties necessary to meet the most exacting potting specifications. In these Westinghouse rectifiers excellent resin adhesion and strength eliminate mechanical support for the plates, thus greatly reducing overall size. With low shrinkage on curing, a first-class hermetic seal is achieved. The formulation possesses good electrical properties — resistance at high working temperatures and the ability to withstand repeated thermal cycling.

Epikote Resins help in many ways to make better products. Have you explored their possibilities yet — for the improvement of existing products or the development of new ones?



EPIKOTE EPOXY RESINS

solve many production problems

SHELL

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SHELL CHEMICAL COMPANY LIMITED, Marlborough House, 15-17 Gt. Marlborough Street, London, W.1. Tel: GERrard 0666.

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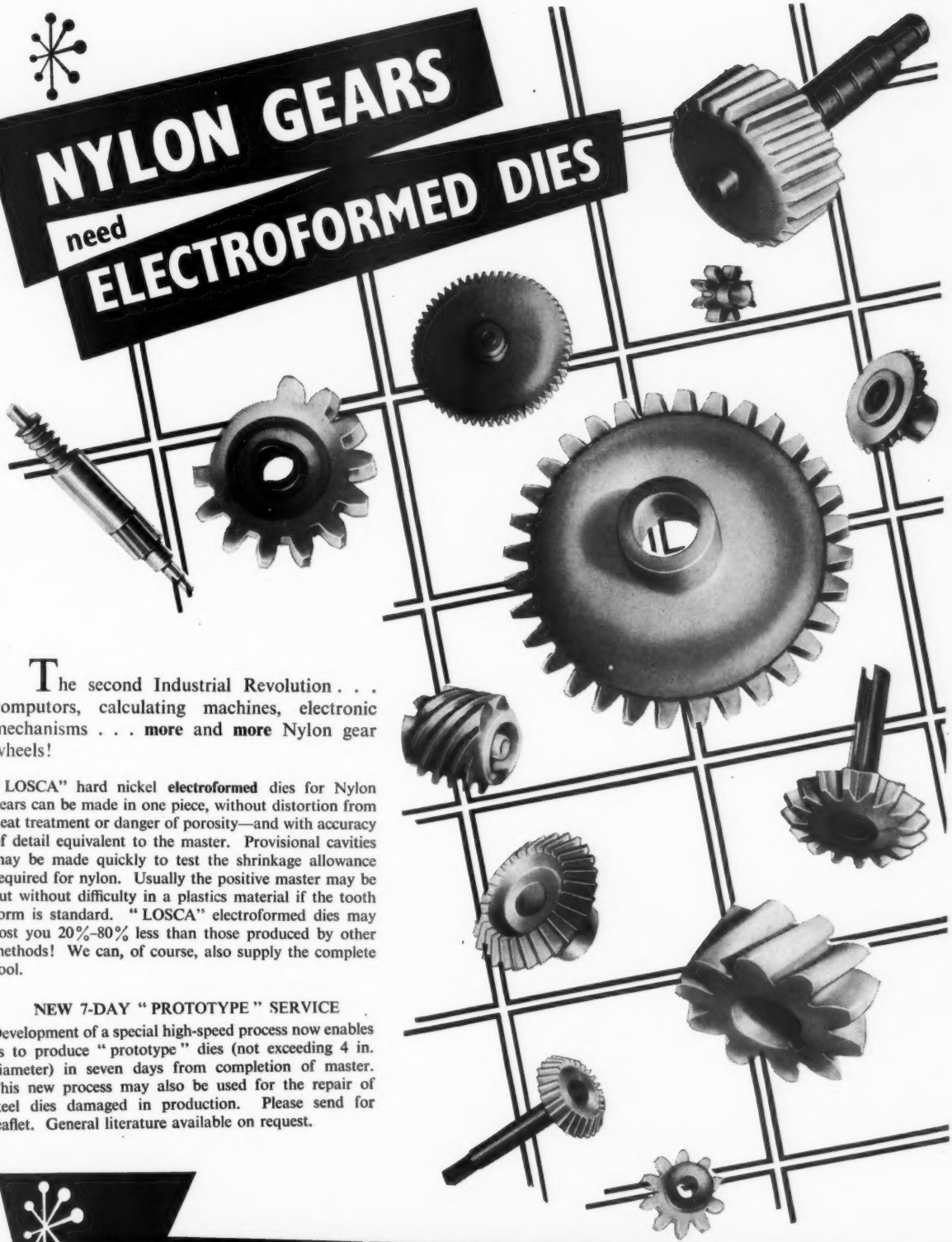
NYLON GEARS need ELECTROFORMED DIES



The second Industrial Revolution . . . computors, calculating machines, electronic mechanisms . . . **more** and **more** Nylon gear wheels!

"LOSCA" hard nickel **electroformed** dies for Nylon gears can be made in one piece, without distortion from heat treatment or danger of porosity—and with accuracy of detail equivalent to the master. Provisional cavities may be made quickly to test the shrinkage allowance required for nylon. Usually the positive master may be cut without difficulty in a plastics material if the tooth form is standard. "LOSCA" electroformed dies may cost you 20%–80% less than those produced by other methods! We can, of course, also supply the complete tool.

NEW 7-DAY "PROTOTYPE" SERVICE

Development of a special high-speed process now enables us to produce "prototype" dies (not exceeding 4 in. diameter) in seven days from completion of master. This new process may also be used for the repair of steel dies damaged in production. Please send for leaflet. General literature available on request.

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Transparent acetate film with a sparkling success. Clear as crystal for packs that stop the shopper's eye . . . smooth as satin for colour-rich laminations. Show it in 'Clarifoil' and sell it!

Pack by W. & F. Walker Ltd.

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'Cellastine' acetate sheeting has strength, colour and versatility plus top-flight performance under vacuum forming and other methods of fabrication. Leading concerns choose 'Cellastine' for better results.

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Spectacles by J. H. Newbury Ltd.

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Colourful 'Celastoid' acetate sheet is keyed to the latest trends in frame styles. For industrial personnel protection too, safety equipment manufacturers specify shatterproof transparent 'Celastoid'.

. . . in the world of plastics

Photo: the Land Settlement Association.

Celawrap
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'MONOFLEX' *extruded flexible sections;* 'WIREWELD' *reinforced sheet;* 'CINEMOID' *non-flam sheeting.*

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Leading in design and performance, Windsor machines are helping to boost production throughout the plastics industry. Famous for reliability and ease of maintenance, Windsor machinery is in constant demand in all parts of the world, convincing proof of their ability to increase output and cut costs.

Literature illustrating full range of machines available on request.

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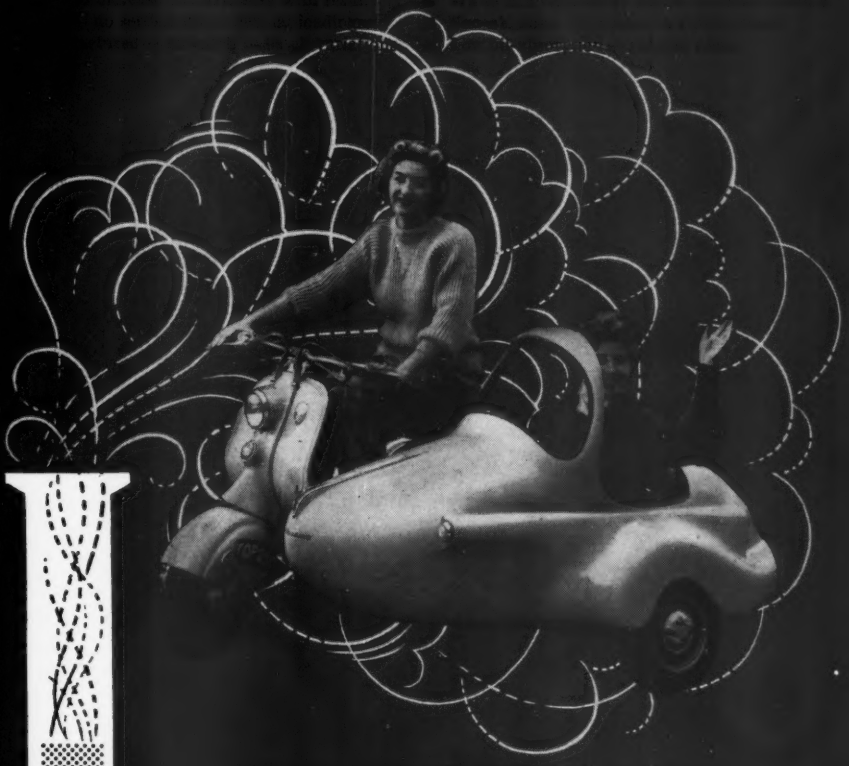
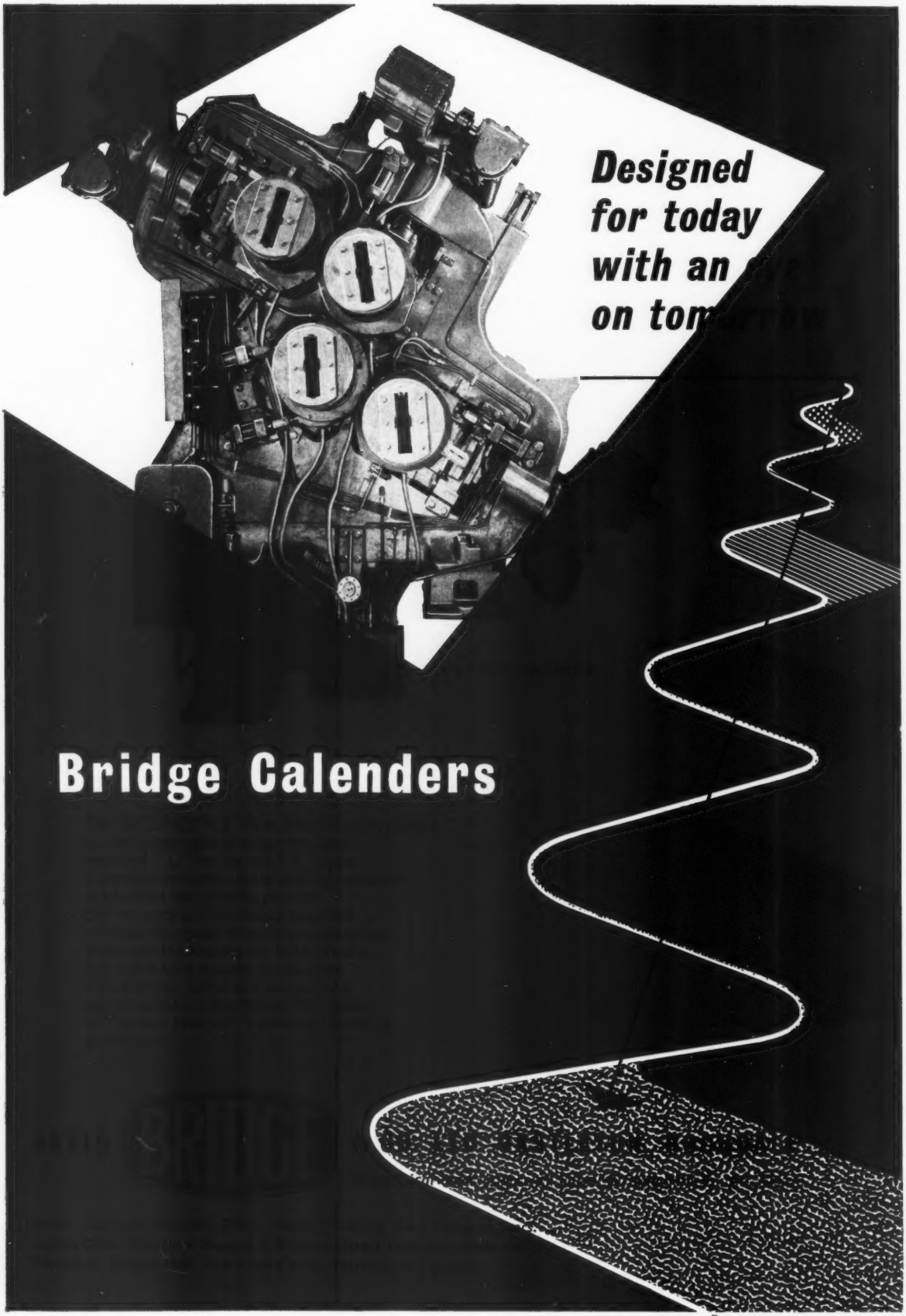


JOHN & E. STURGE LIMITED

Wheeleys Road, Birmingham, 15. Telephone : Midland 1236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COLOUR . . . BRILLIANT . . . PERMANENT

Throughout the plastics industry, Matthey cadmium pigments are known and employed for their reliability in the most arduous conditions of manufacture or of use. Combining brilliance with stability, providing high colouring power with resistance to heat, to light and to chemical attack, these remarkable pigments are available in a range from bright yellow to deep maroon.

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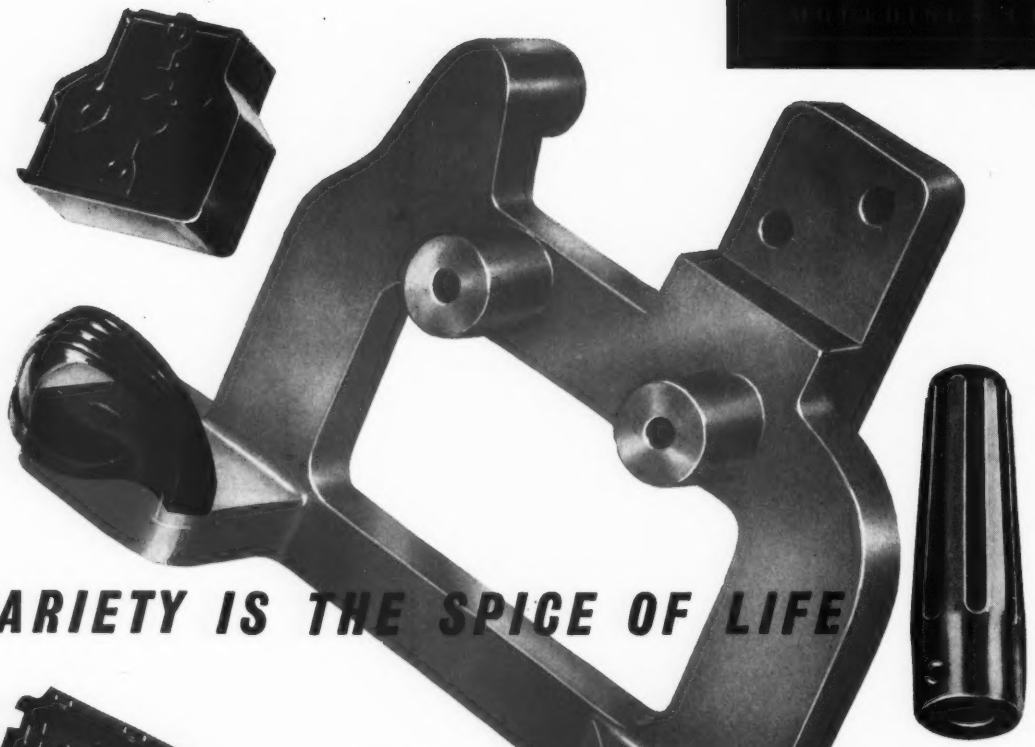
ROOTES



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That's why we at ROOTES MOULDINGS find life so interesting. · Our clients confront us with a diversity of problems to solve. It's right up our alley because we can supply the complete solution within our own organization.
We design mouldings, make the tools and our craftsmen, aided by the most up-to-date precision equipment, start production immediately.
The result—a first class job at a competitive price.
For all plastic moulding problems consult us now—we're confident we can help you.

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For all compression mouldings

Contractors to M.O.S., Admiralty, etc. A.I.D. Approved

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[redacted]

knock at any door...?

The Pressed Steel Company Limited were looking fo
an attractive, functional easy-to-clean evaporator do
for their new Prestcold refrigerator.
It was our kind of job..... technicians and workmen
rolled up their sleeves—and here you see
the result, this high impact Polystyrene door.
Simple, streamlined, effective—altogether a pretty
good job. Least ways that's how our clients,
The Pressed Steel Company Limited feel about it—
and we at Rootes Plastics like to think so too.
No matter how big or small, if your problem is plastics bring it to the Rootes door—you won't even have to knock.

RE INJECTION MOULDINGS IN
F THERMOPLASTIC MATERIALS

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For all [redacted] *uldings*

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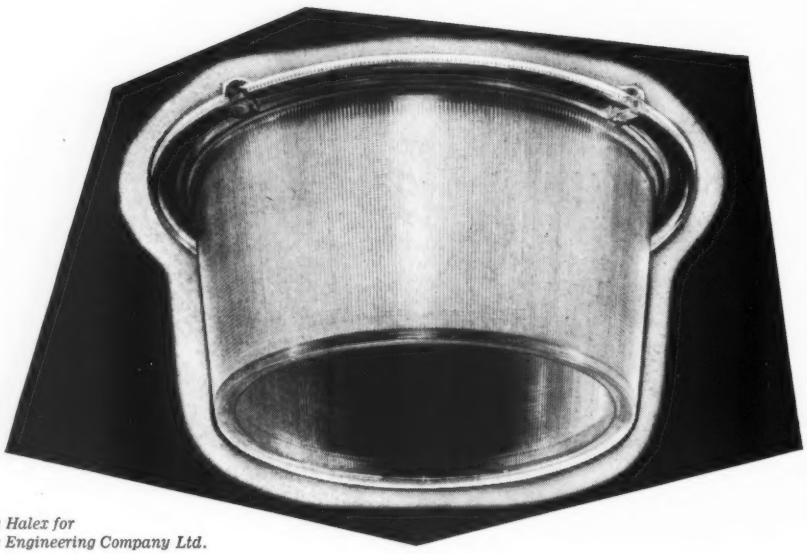
All the better to see you with . . .



Moulded by Halex for
The Wardle Engineering Company Ltd.

The street lantern refractor is, in fact, two separate mouldings—the inner carrying horizontal prism forms on its outer face, and the outer carrying vertical prism forms on its inner face. The two are cemented together so that the prisms are hermetically sealed and the unit is quite smooth both inside and out—important from maintenance and cleaning points of view.

If you have a problem involving plastics, why not ask us to come and see about it? If anyone can help, we can. In any case, why not write for a copy of our new Industrial Plastics Booklet? It's full of information—and quite free.

HALEX

INDUSTRIAL PLASTICS DEPARTMENT

(a Division of the British Xylonite Co. Ltd.)
Dept. P., HIGHAMS PARK, LONDON E.4. Telephone: LARKSWOOD 2345

Three frozen cheers for Electrolux

H'rm . . . H'rm! — said the MD clearing his throat: I have great pleasure in proposing a toast *(CHEERS)* to the Electrolux boys *(LOUD CHEERS)* on the production at Luton of their millionth fridge *(IMMENSE AND PROLONGED APPLAUSE)*.

Ladies and gentlemen, only a company of immense skill and enthusiasm in every department could make a million refrigerators for a people who are undoubtedly more cold more often and at more unlikely seasons than any nation in the world. Such a company is the Electrolux Company! *(MORE CHEERS mixed with cries of BRING ON THE TOAST)*. If proof of the far sightedness, the deep wisdom, the high technical intelligence of this Company be asked, I need only say that in every department of Electrolux only the best men, the best materials and THE BEST TOOLS ARE GOOD ENOUGH — AS IS PROVED *(he cried, raising his voice to a fortissimo)* BY THEIR INCREASING USE OF

DESOUTTER TOOLS!

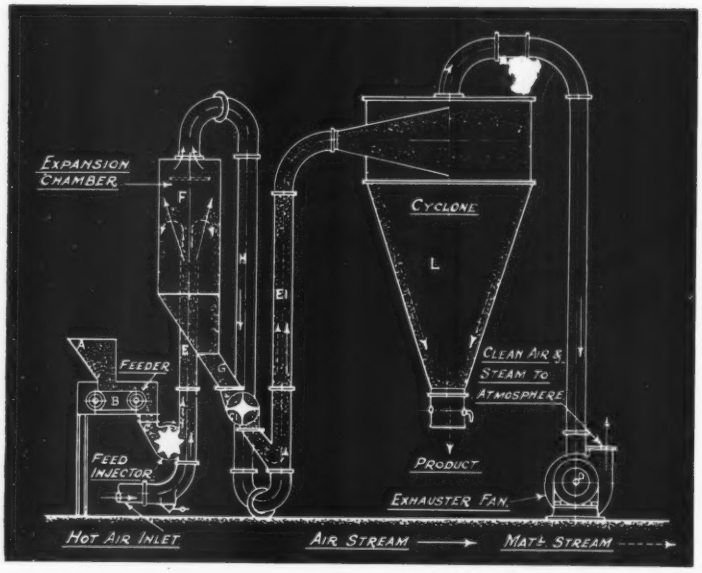
(loud cries of "Oh . . . you self-advertising cad!" and "Push him in the fridge!")

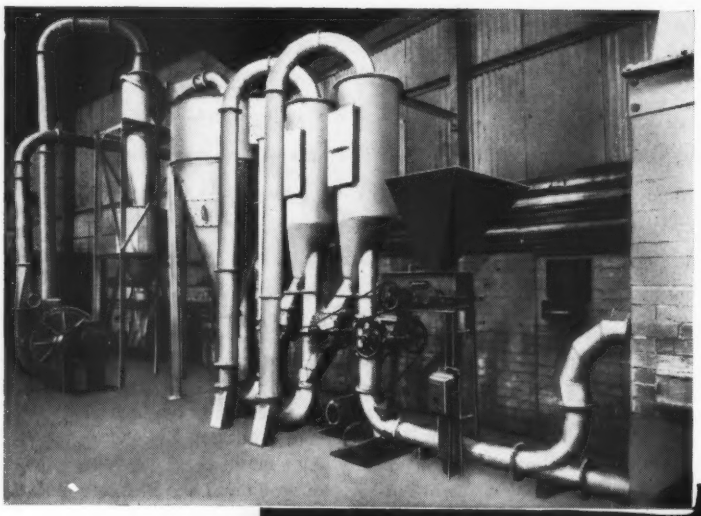
DESOUTTER BROS. LIMITED, THE HYDE, HENDON, N.W.9. TEL: COLINDALE (5 LINES) GRAMS: DESPNUCO HYDE, LONDON.

CRC286

B

sawdust dances in *HOT AIR STREAM*





For drying sawdust and other filler ingredients for plastics, the British Rema Pneumatic Dryer is quick and effective and takes up relatively little space.

At all times during the drying the particles are separated and swept by high-velocity hot gases; this gives an extremely rapid transfer of moisture from the material to the air stream—drying takes place in less than one minute and the material never has time to get too hot.

This system of pneumatic drying is also very suitable for any materials which are easily damaged by breakage or overheating—flaked materials, crystalline products, etc.

Sizes: from ½ ton to 20 tons per hour.

BRITISH 'REMA' PNEUMATIC DRYER

BRITISH 'REMA' MANUFACTURING CO. LTD.
PROPRIETORS: EDGAR ALLEN & CO. LIMITED
IMPERIAL STEEL WORKS · SHEFFIELD 9

PI/BR25

To British 'Rema' Manufacturing Co. Ltd
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Please post "Drying Equipment" to:

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Position.....
Firm.....
Address.....

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Flamborough Head

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"ELO" SYNTHETIC RESIN PRODUCTS

"ELO" MOULDINGS for all classes of industry
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"ELO" RESINS for all Bonding, Laminating, Abrasive, and Friction material applications. Anti-Friction Resin for Fabric Bearings. Resins for Textile Paper Tubes and Bobbins. Cements, Lacquers, Insulating Varnishes.

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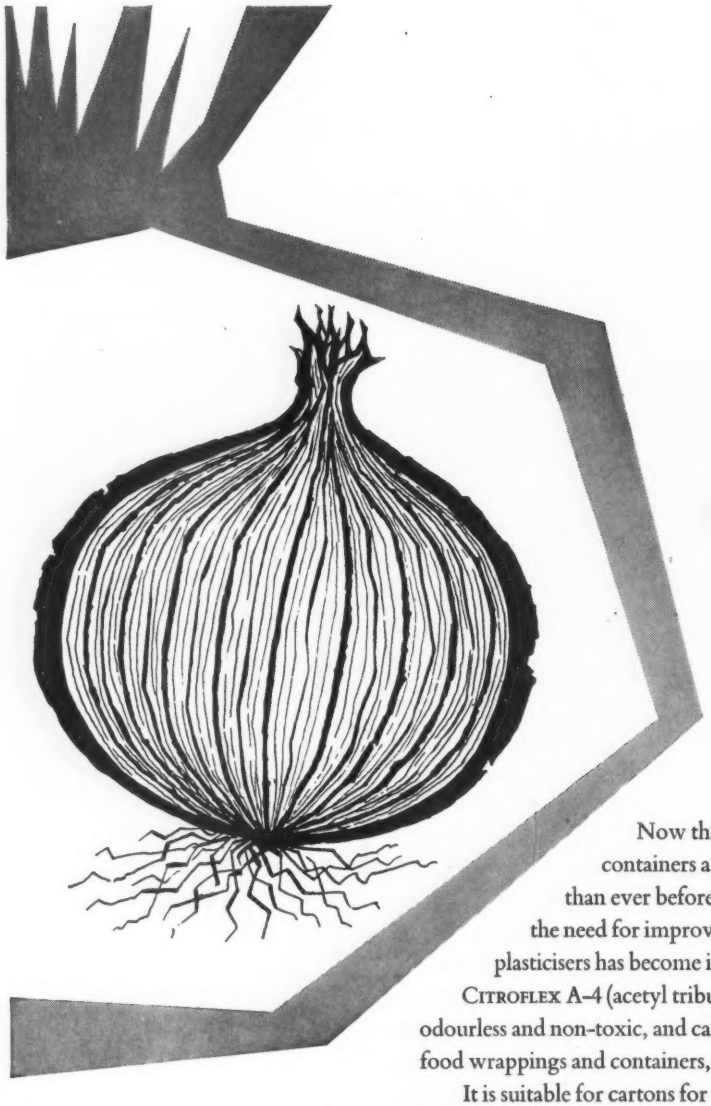

Safe . . . and odourless

Now that plastic wrappings and containers are being used to a greater extent than ever before in the packaging of foodstuffs, the need for improved, odourless and non-toxic plasticisers has become increasingly important.

CITROFLEX A-4 (acetyl tributyl citrate) is completely odourless and non-toxic, and can be used in the manufacture of all plastic food wrappings and containers, including those intended for fatty foods.

It is suitable for cartons for dairy produce, bottle caps for soft drinks, seals for preserving jars, and many other applications.

CITROFLEX A-4

PFIZER CITROFLEX*

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Distributors: Kingsley & Keith Ltd., 110-112, Victoria Street, London, S.W.1. *Phone:* TATe Gallery 4092

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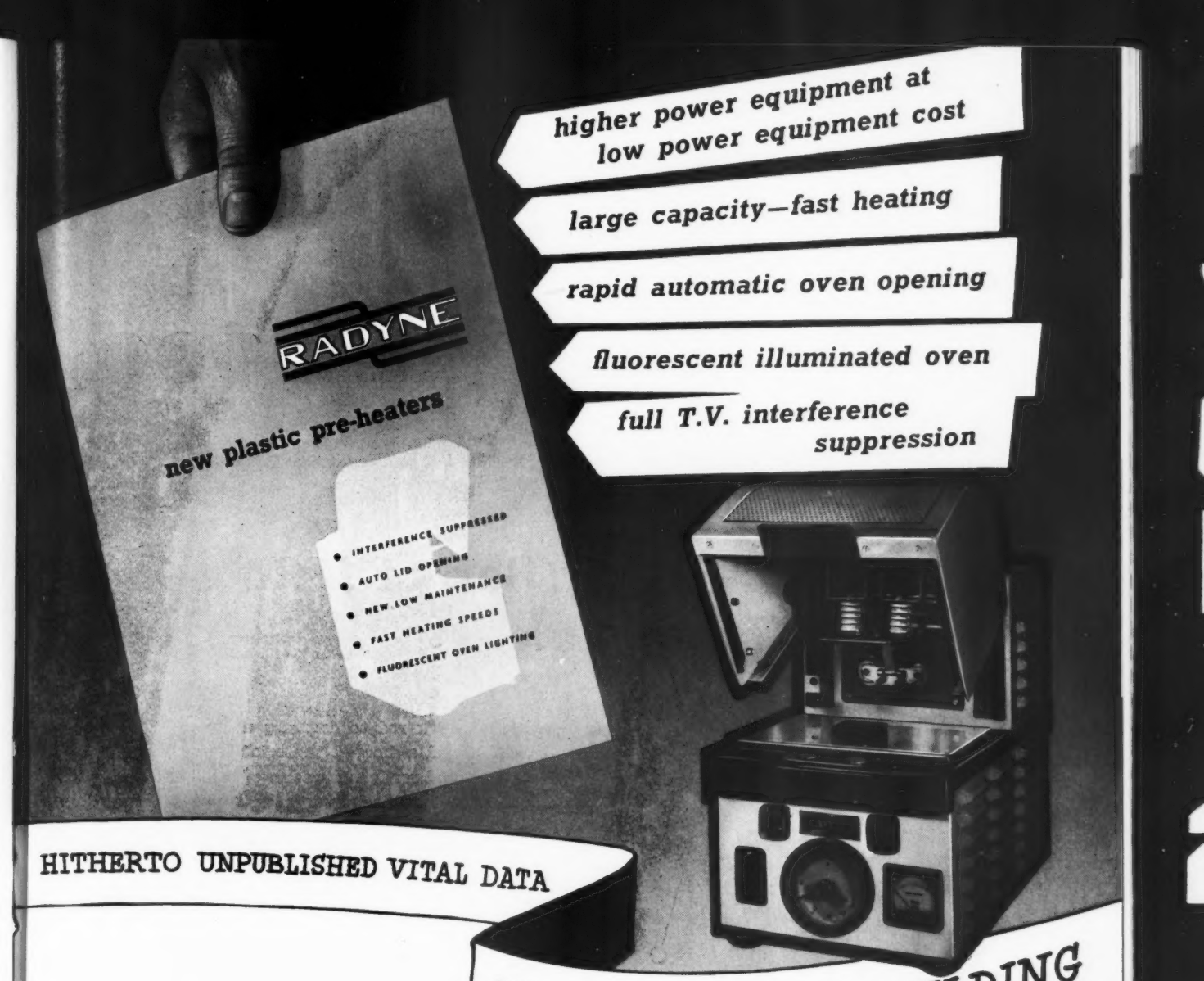


higher power equipment at low power equipment cost

large capacity—fast heating

rapid automatic oven opening

fluorescent illuminated oven

full T.V. interference suppression

HITHERTO UNPUBLISHED VITAL DATA

ON PLASTIC MOULDING

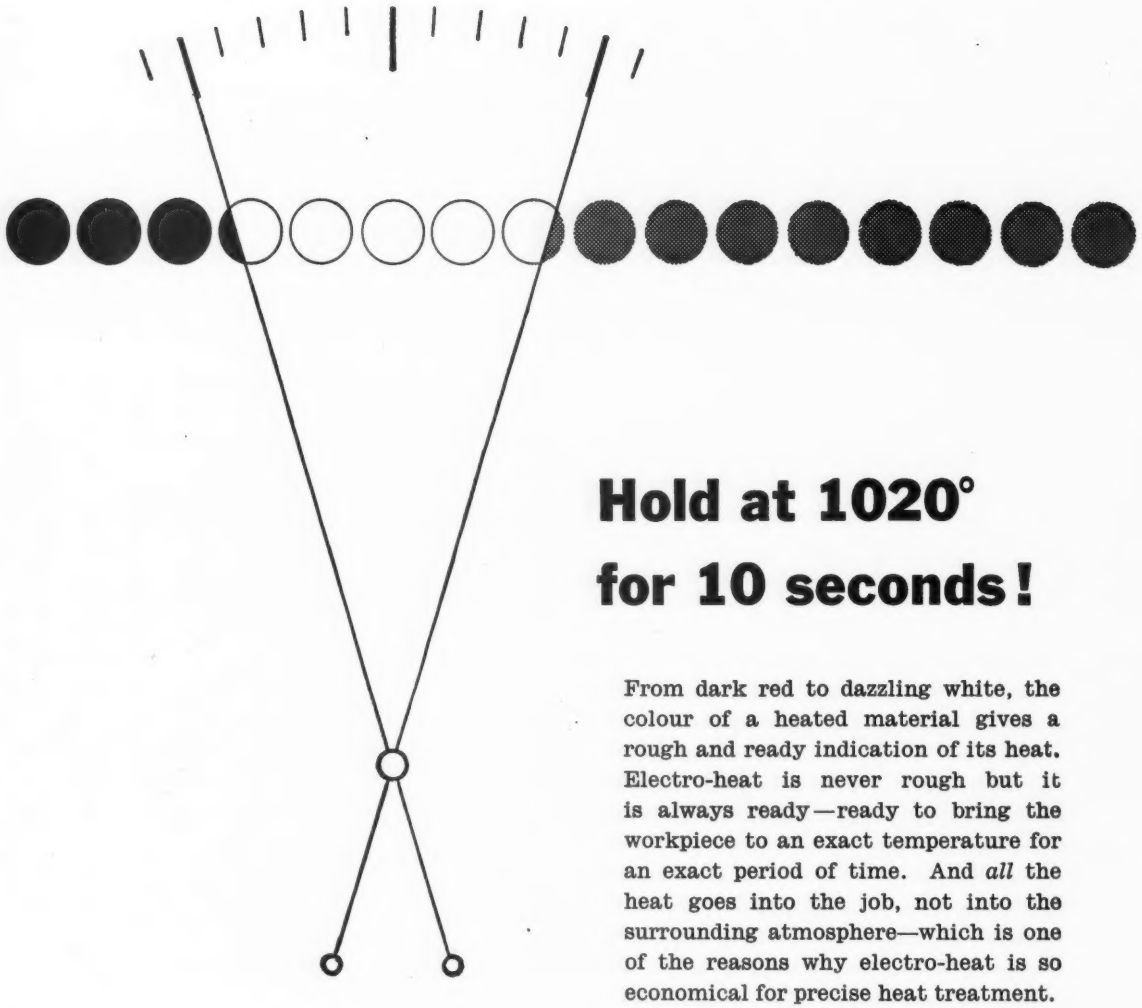
YOURS-for the asking

The most important technical information ever revealed to the plastics industry is contained in this document describing a new concept in compression moulding. New Radyne Preheaters are backed by comprehensive 1-year guarantee — maintenance costs reduced to a minimum — interference suppressed — suitable for pellet, powder or flake.

MODEL	kW	PRICE
H.3	0·3	£175
H.6/C	1	£295
H.15/B	2	£475
H.30	5	£595
H.50/B	6	£920
H.80	9	£1,150
H.180	18	£2,100
H.280	28	£2,300

radio heaters ltd

WOKINGHAM BERKS ENGLAND TELEPHONE WOKINGHAM 1030 (6 LINES)



Hold at 1020° for 10 seconds!

From dark red to dazzling white, the colour of a heated material gives a rough and ready indication of its heat. Electro-heat is never rough but it is always ready—ready to bring the workpiece to an exact temperature for an exact period of time. And *all* the heat goes into the job, not into the surrounding atmosphere—which is one of the reasons why electro-heat is so economical for precise heat treatment.

In every industry, for scores of applications, electricity means higher productivity.

Electricity for Productivity

'Induction and Dielectric heating', just published, is a very important addition to the E.D.A. series of books on Electricity and Productivity. Other titles available are Electric Motors and Controls, Higher Production, Lighting in Industry, Materials Handling, and Resistance Heating. Price 8/6, or 9/- post free.

If you would like further advice or information on how electricity can improve productivity, get in touch with your ELECTRICITY BOARD, or with E.D.A. They can lend you, without charge, films about the uses of electricity in industry.

Issued by the
British Electrical Development Association
2 Savoy Hill, London, W.C.2

At first it may look impossible –

BUT THROUGH THE EYE
OF AN EXPERT IT MAY
BECOME POSSIBLE

P & B
INJECTION
MOULDING

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(MOULDINGS) LTD.
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SHAW

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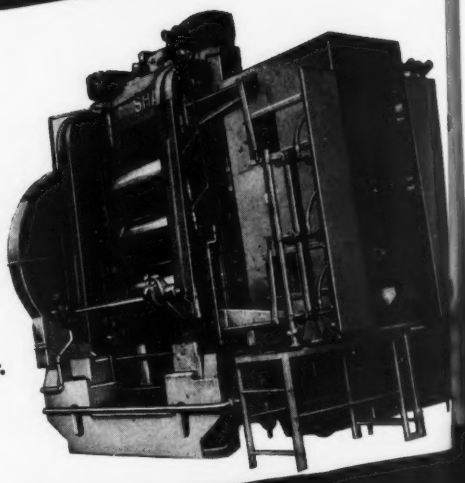

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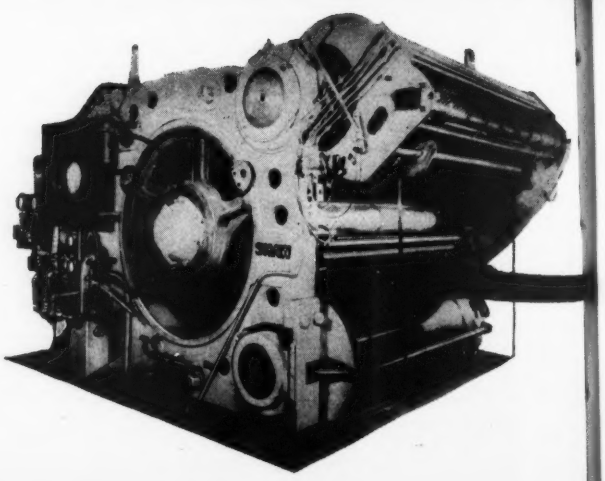

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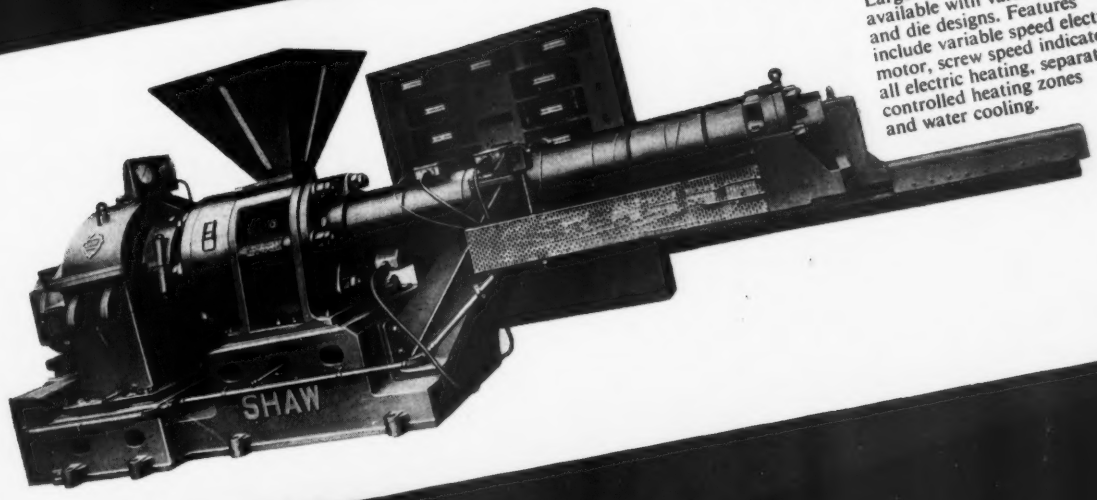

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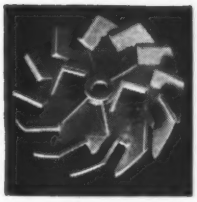

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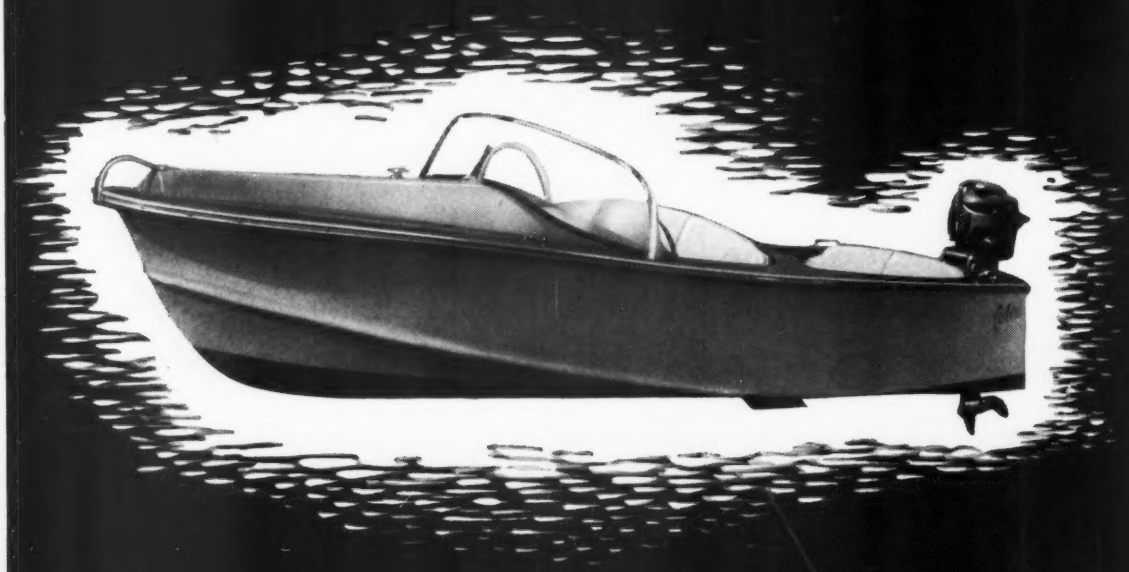

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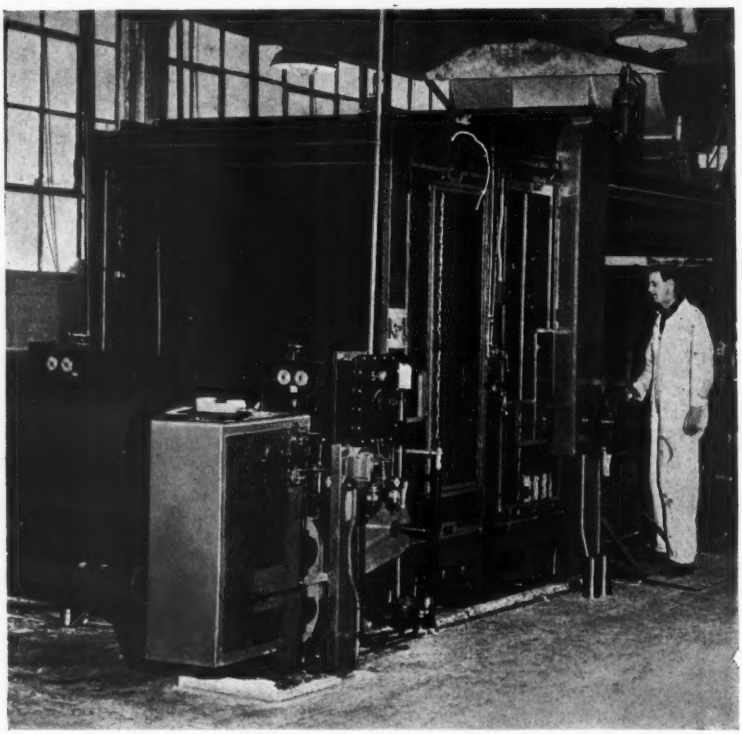

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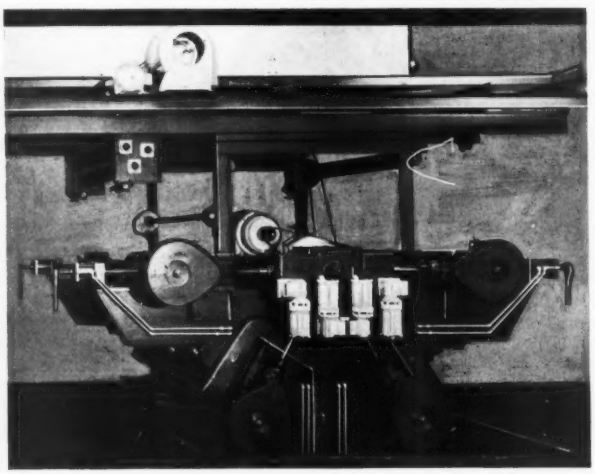

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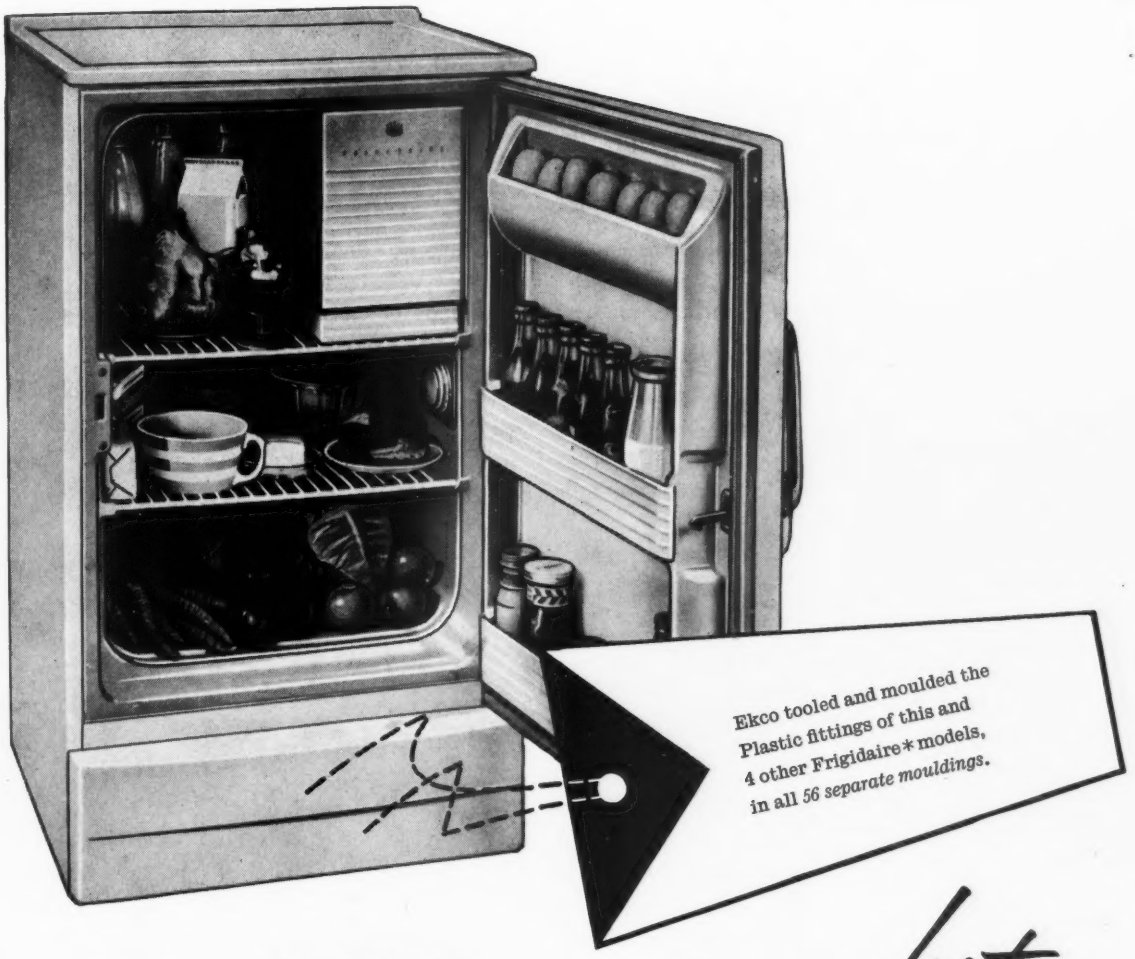

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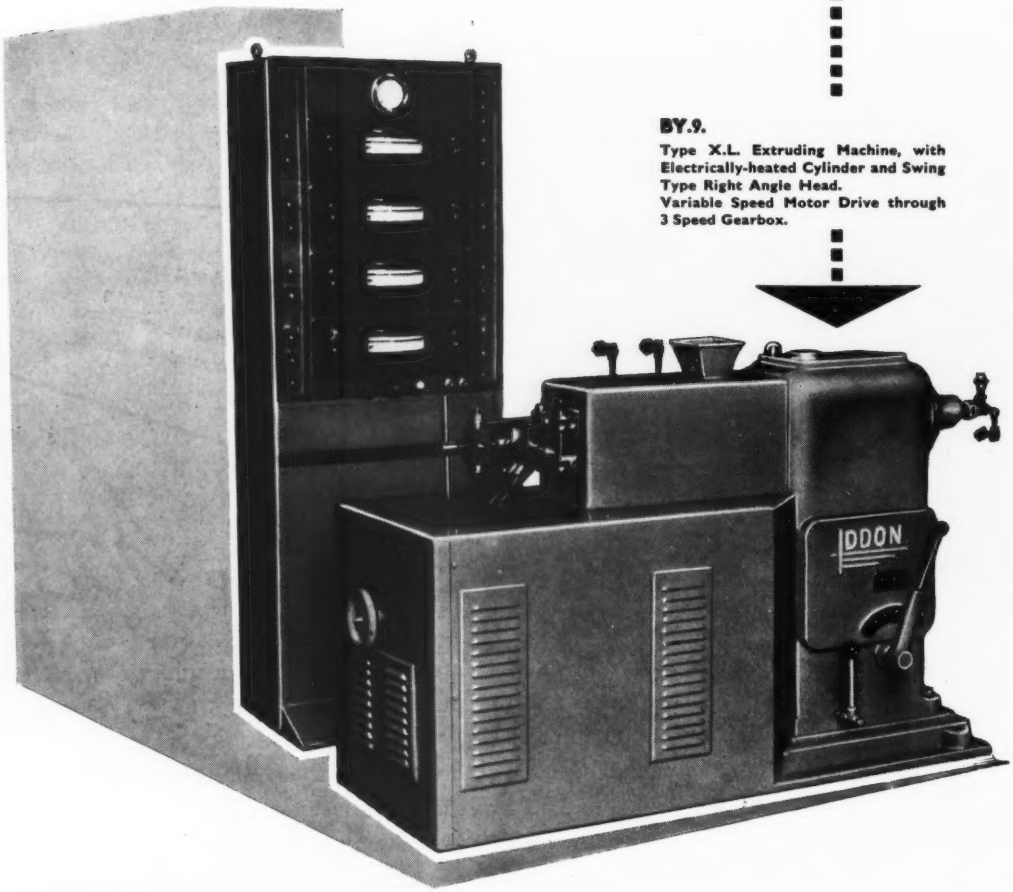

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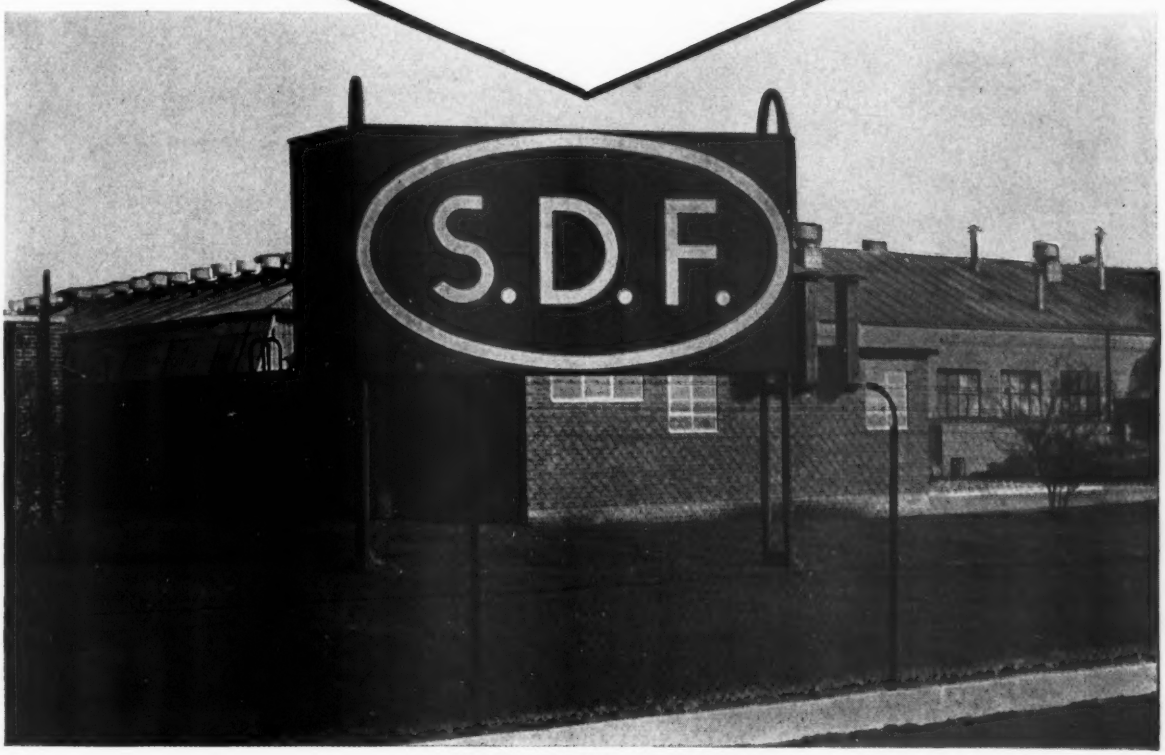

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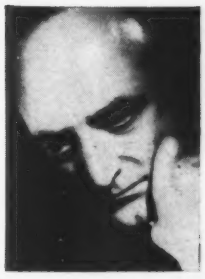

M. Jean Royère is an industrial designer of international repute. He expresses below his convictions about colour and forecasts the impact this new thinking will have on our everyday lives.

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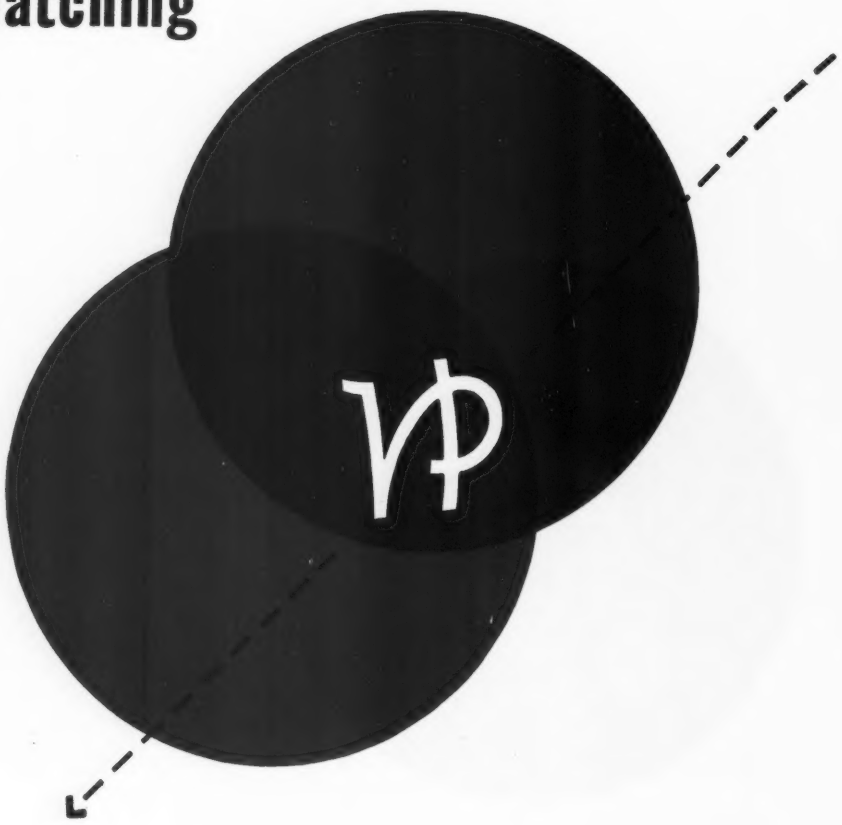

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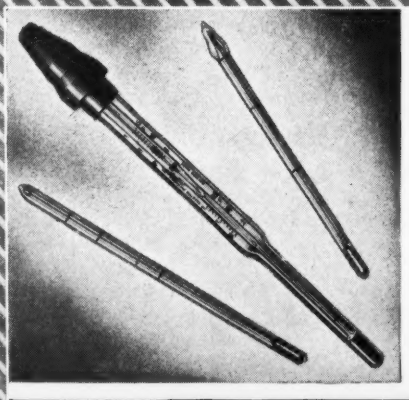

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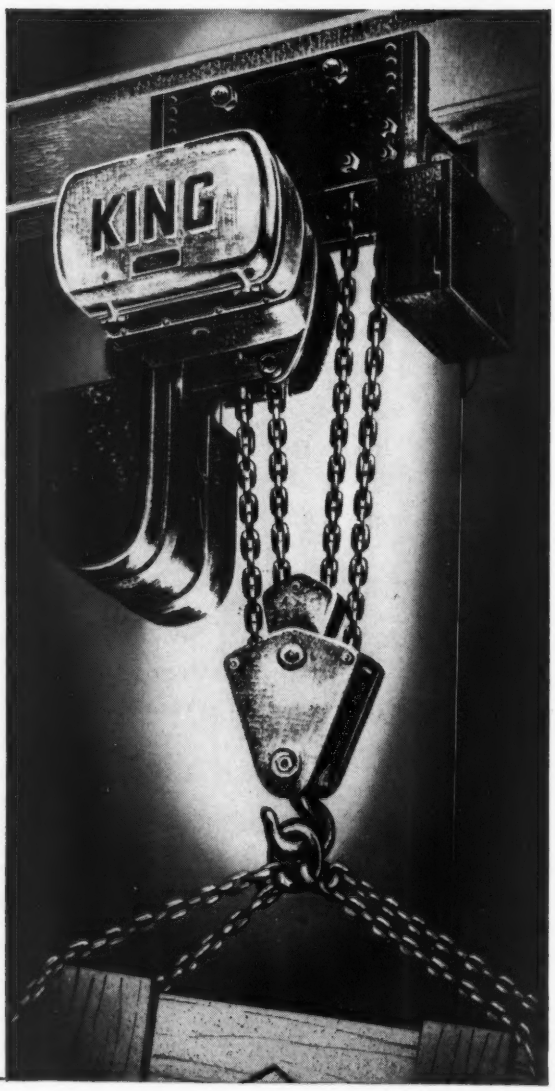

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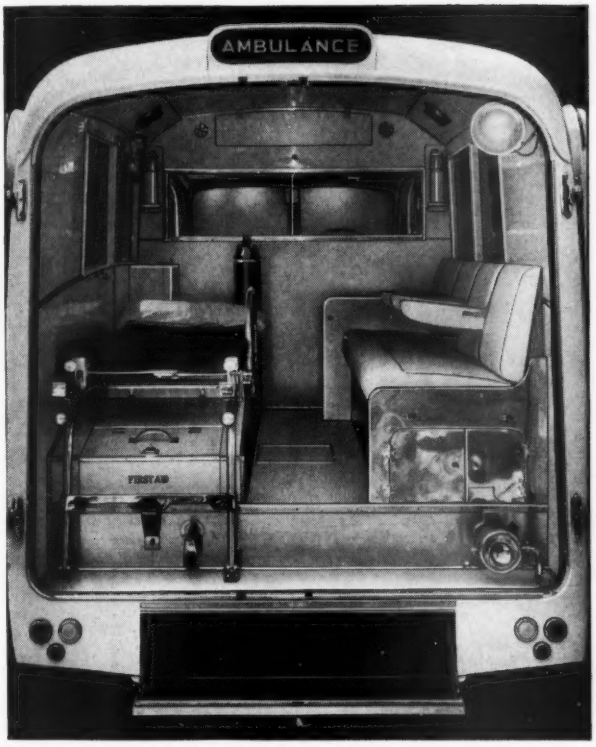

Rear view of the Morris LC.5 Ambulance, coachwork by Wadham Bros. Ltd. Front and rear doors are moulded in two halves and joined. Inserts for fixing hinges, handles and fittings are integrally moulded.

For their Morris LC.5 Ambulance Series, as supplied to many Authorities, Wadham's have standardised on structural plastics for doors, roof, rear wings and wheel arches. For other vehicles this strong, easily-moulded polyester/glass fibre material is used for numerous applications such as interior roof lining panels, window finishers, sign boxes, etc. Just another aspect of the now familiar Beetle polyester story—a story of strength, lightness and non-corrosion; and lower maintenance and repair costs.

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for strong, easily-produced coachwork components

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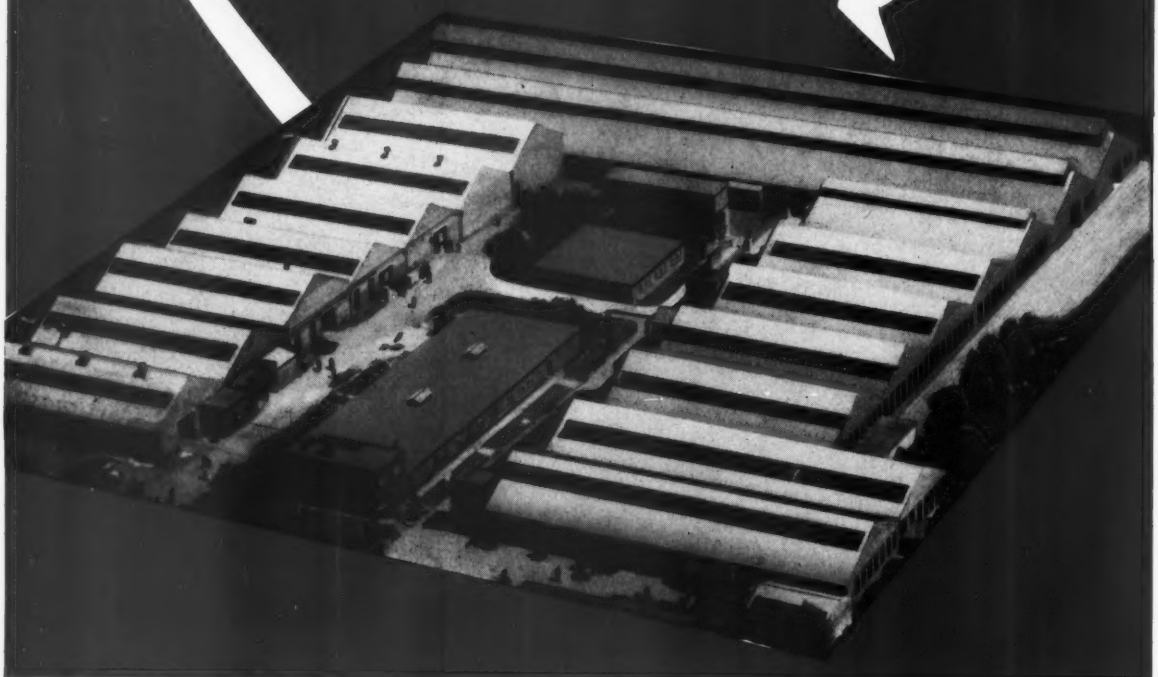

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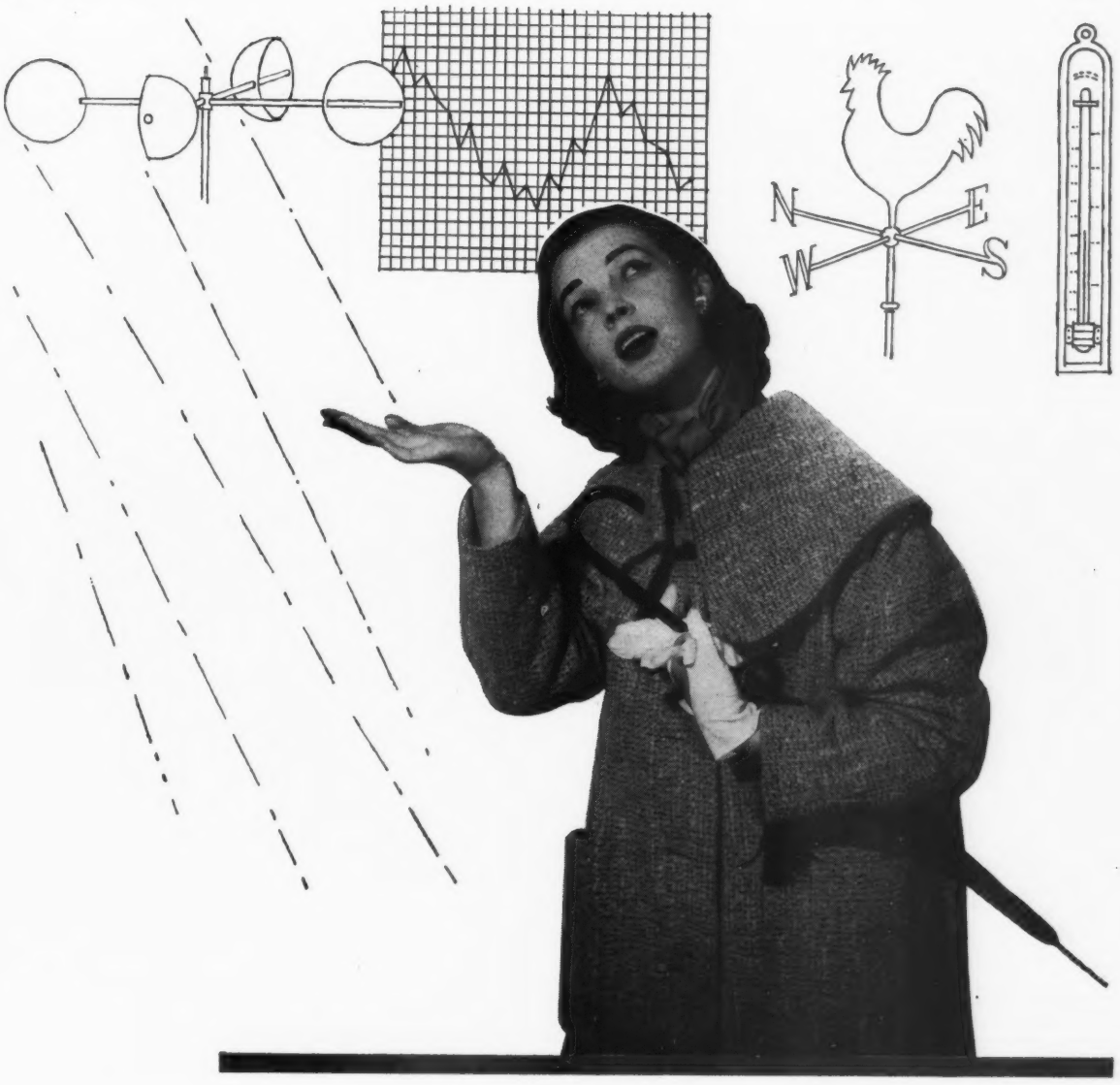

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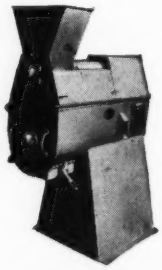

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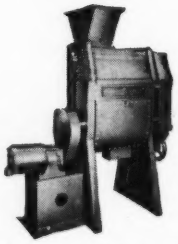

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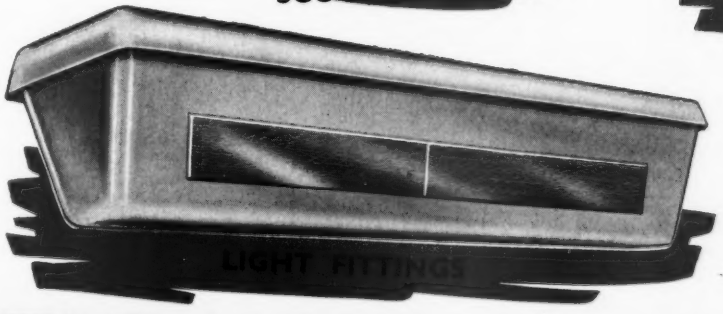

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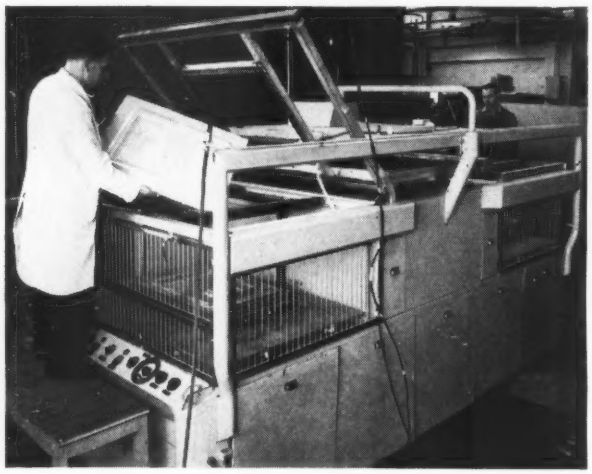
Photograph of double ended vacuum forming machine.



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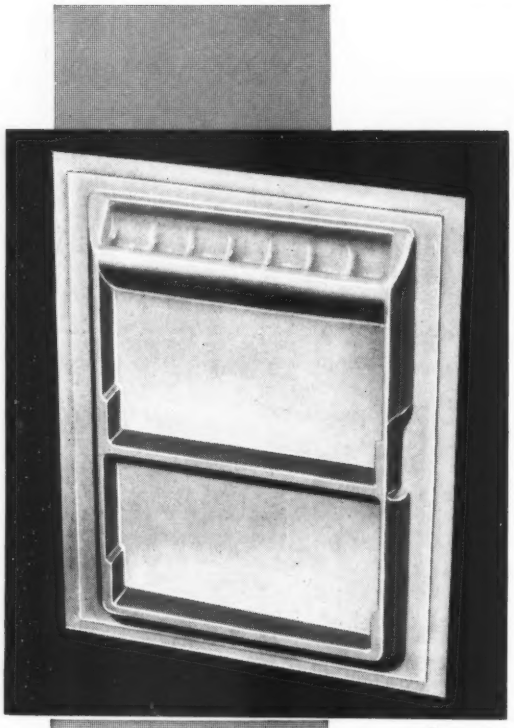
Erinoid

CP.20X for sheet extrusion



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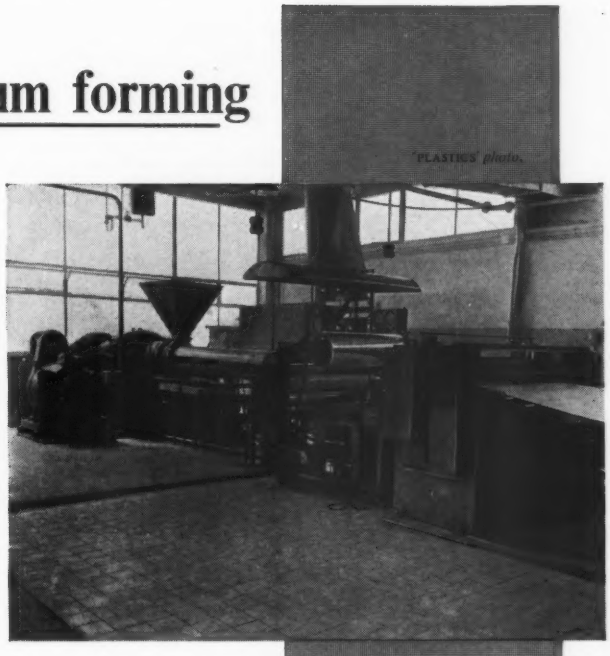

'PLASTICS' photo.

Illustration of typical high impact polystyrene sheet extrusion unit.

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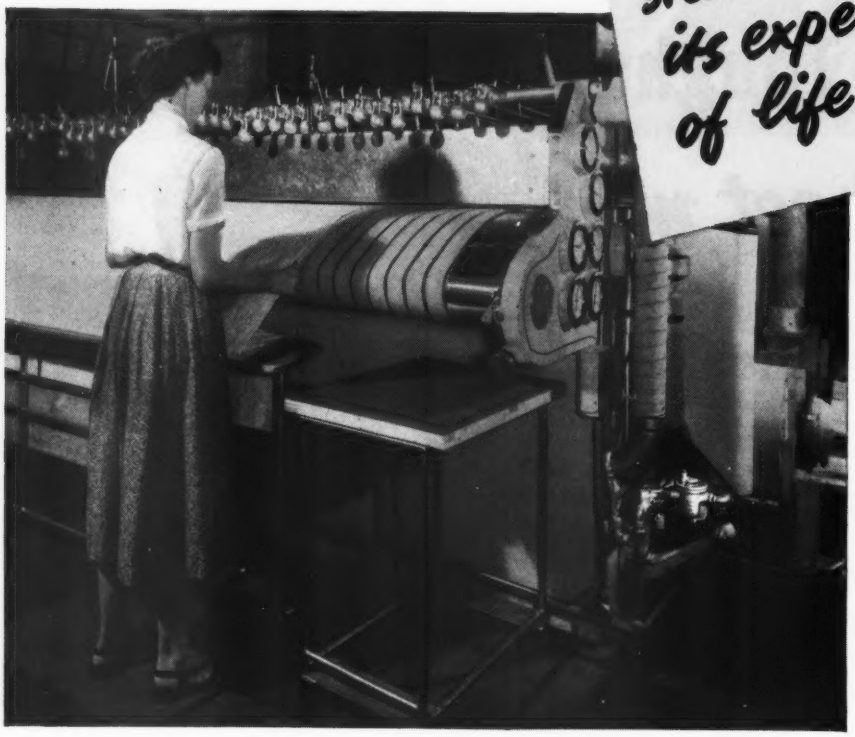

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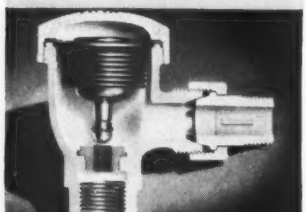

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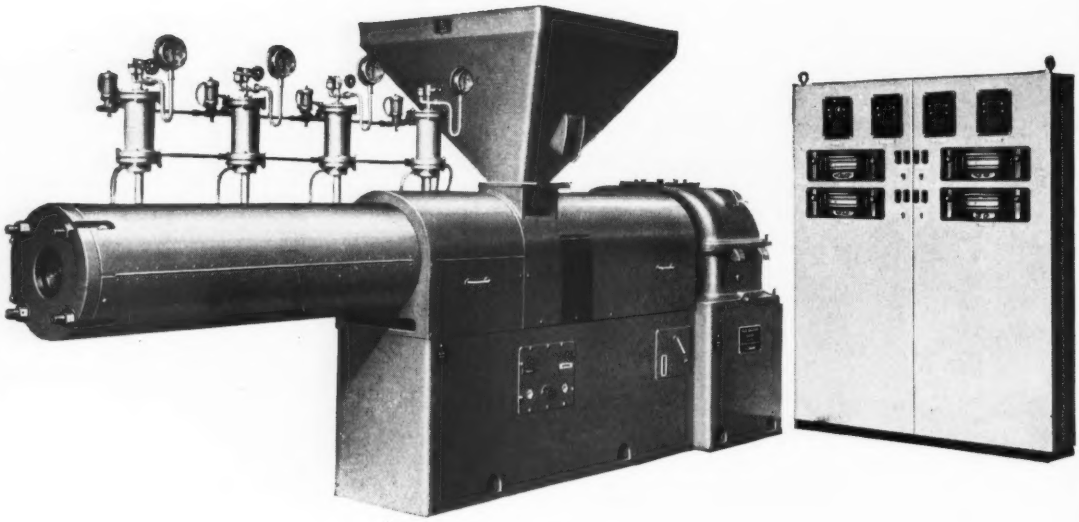

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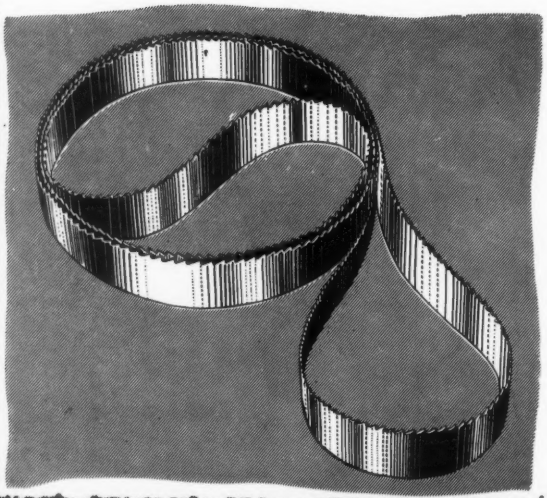

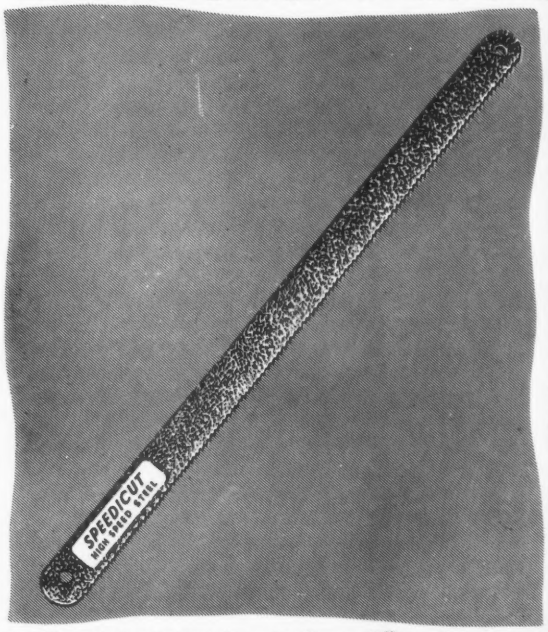

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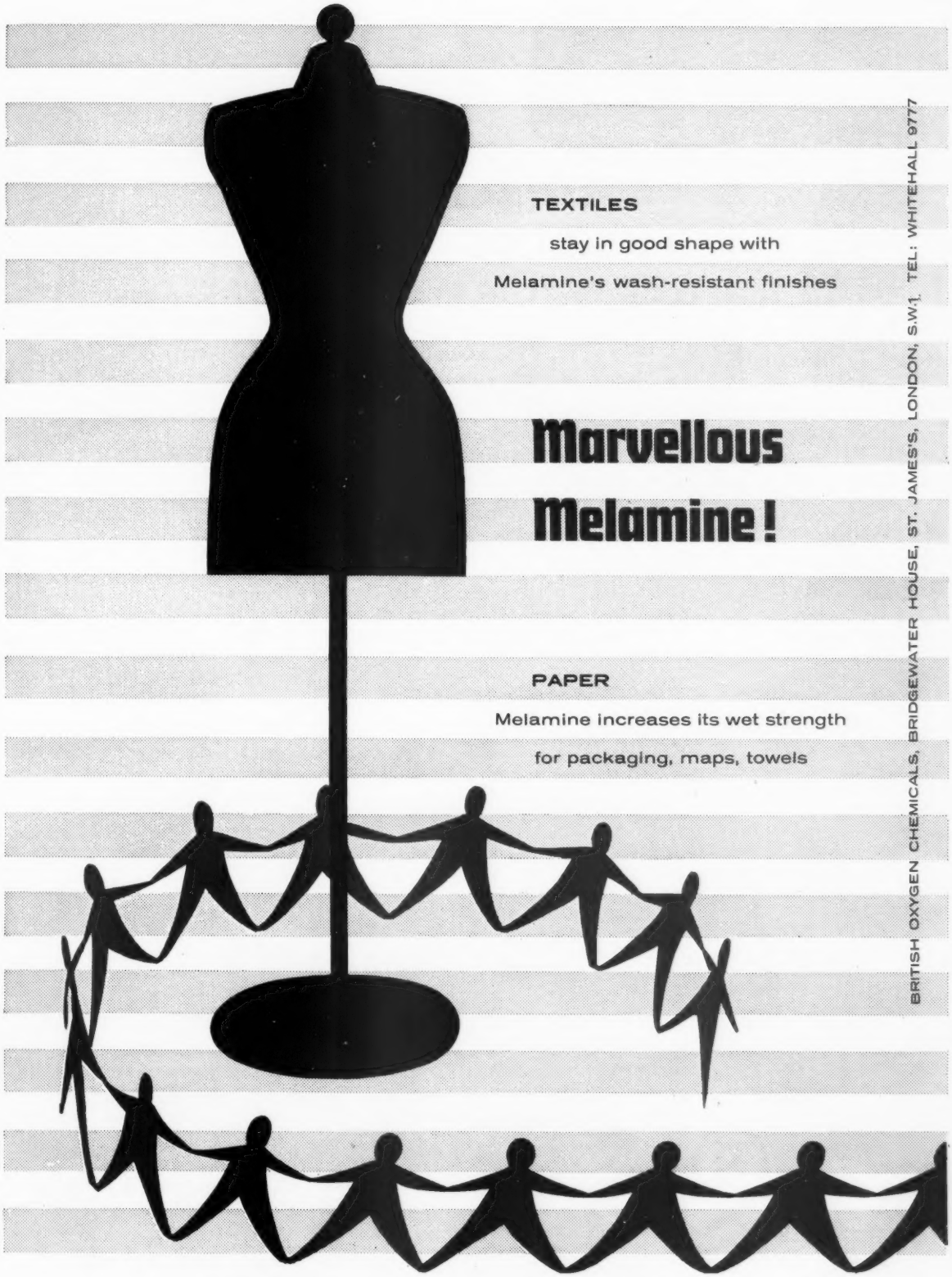

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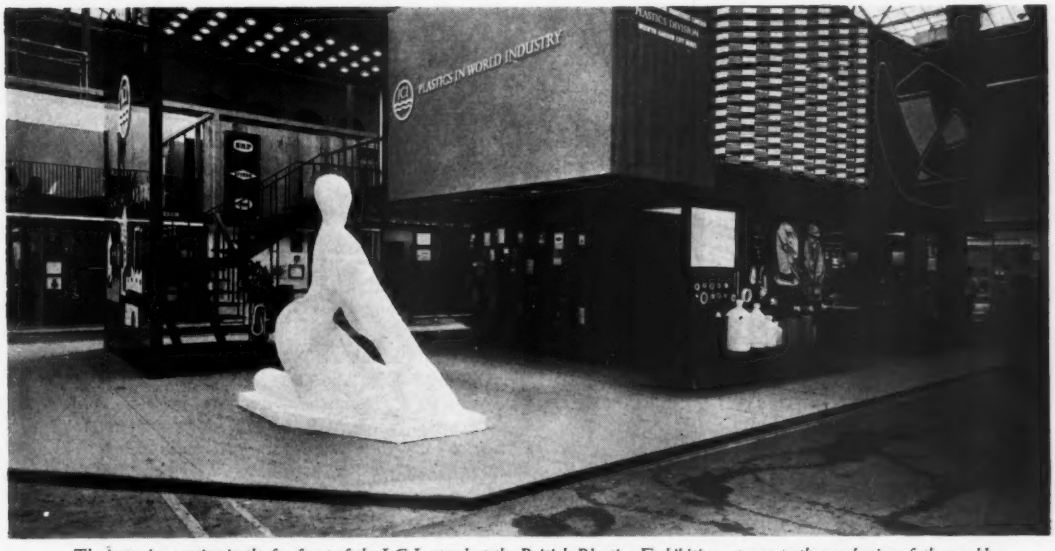

The imposing casting in the forefront of the I.C.I. stand at the British Plastics Exhibition represents the awakening of the world to Plastics. In the August issue of "Plastics" we wrote: "To us it told, simply and clearly, of man's power to create form, purity and even strength out of the earth, out of the inanimate, the formless and the weak, by his intelligence and control of physical forces; thus it became a thing of beauty. It was for us the growth of Plastics."

EDITOR: M. D. CURWEN, B.Sc., A.R.I.C.
ASSISTANT EDITOR: C. W. WELCH

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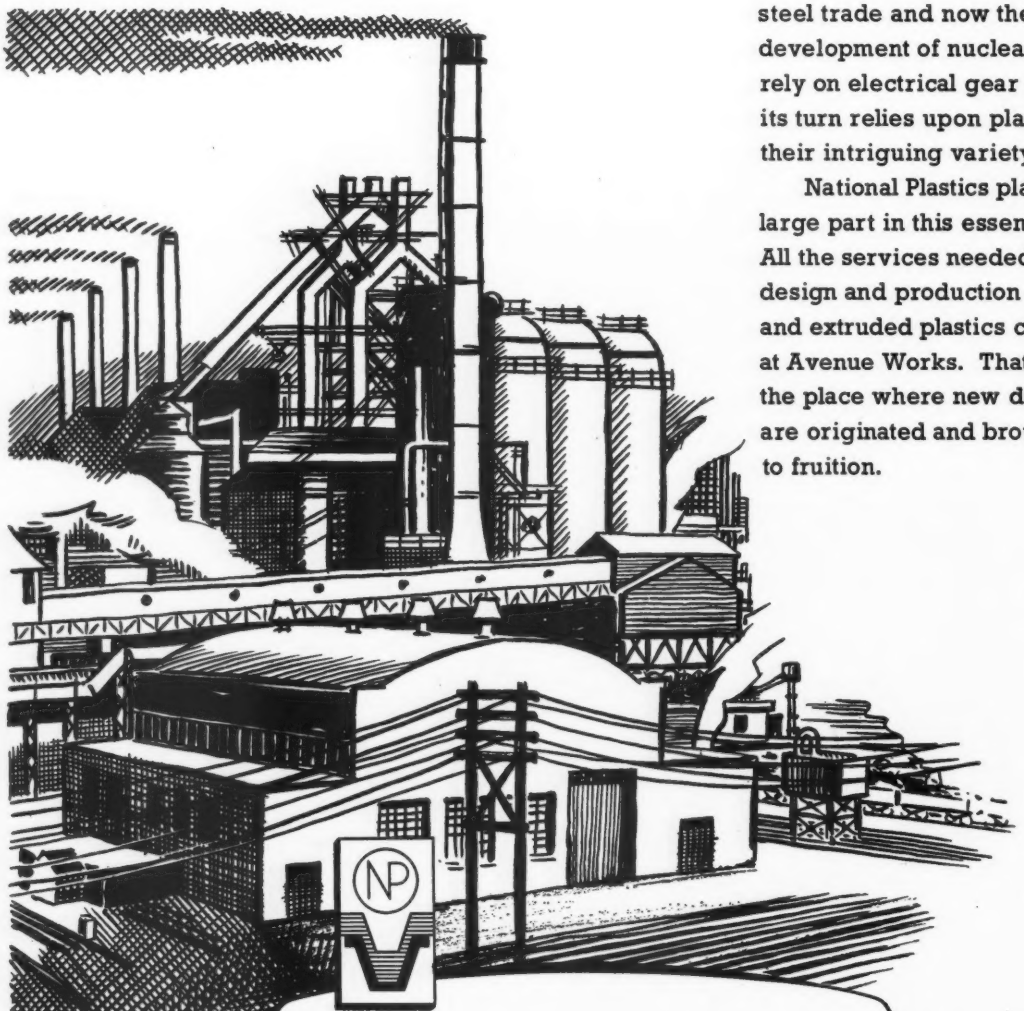

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Plastics

VOL. XXII No. 240 SEPTEMBER, 1957

EDITORIALS

Price Wars

IT is no secret that many plastic manufacturers and converters have for some time been feeling the heat of intense and unfair competition. Indeed, in some branches, its intensity has given rise to talk of a return to the bad days of 1947, a period still in the mind of most of us and during which there waged not only a serious price war but a lamentable battle of quality. A price war within a country maintained at a general level of good quality may produce its good results. When it is carried out, as it was in 1947, in the field of household goods almost entirely on the basis wretchedly low quality, it can be and was in fact throughout 1947, 1948 and 1949, quite disastrous for many.

When the matter is further aggravated by becoming an international problem, it assumes a more serious and more complicated aspect, and we are faced with such a one today.

During a recent tour of plastics manufacturing organizations it became clear that trouble lies ahead for certain sections of the thick sheeting industry unless a radical alteration in the present circumstances takes place.

These are the reports:— Most flexible thick sheeting at the moment is being manufactured at a loss. This is due to an uninhibited price warfare which has been operative since the end of the unofficial price agreement in 1955.

The price war arose, according to the sheet manufacturers, from the impact on the home market of imports of low priced German sheeting. With lower labour costs and a high protective tariff of 31%, the German manufacturer is landing thick p.v.c. sheeting in this country for as little as 2s. 9d. per pound, freight and the 10% duty paid, i.e. a nett price of around 2s. 4d. per lb. which is less than the cost, to the British manufacturer, of raw materials and direct labour. In the protected German home market, the same products are sold for nearly double this price. A large proportion of the German raw materials and also most of the cheapest grades of sheeting, emanate from East Germany, the sheeting being embossed and/or printed and re-exported. These supplies from behind the Iron Curtain are obtained, we understand, on the basis of some system of barter.

The disaster of 1947 is still fresh in the mind not only of the Plastics Industry but its customers as well. Amongst measures taken in 1948 to ensure that this would never happen again, was the formation of a committee by several sheet companies to fix prices. This unofficial agreement resulted in a race for quality, which steadily improved. Shortly after the formation of this committee preparatory work began on British Standards Specifications 1763 and 2739, the existence of which, it was hoped, would permanently stabilize at least the thin sheeting industry. Unfortunately this plan for the maintenance of quality was completely negatived by the price war which arose from the immense influx of German sheeting in 1955 (over 1,000 tons, mainly thick). In p.v.c. sheeting variations of quality are mainly detectable only by laboratory tests and in a shortsighted market governed chiefly by the price angle, regard for specifications receives little support. Slowly but surely the quality of a large proportion of the sheeting produced in this country is deteriorating, particularly in the thicker gauges. For a considerable time the sheet manufacturers have been attempting to rectify the position by negotiation with the Board of Trade in the hope that a realistic tariff will be placed upon imported continental sheeting.

Some prominent companies have already withdrawn from the sheet manufacturing field; for the rest the outlook is decidedly sombre, unless the Board of Trade negotiations are successful, for these companies are mostly only able to continue sheet manufacture because of other activities in the plastics field. The outcome of this downward spiral of prices could be the wholesale distribution of poor quality sheeting heavily filled, with resultant consumer resistance fully comparable with that of 1947. A second dose of that medicine might well easily affect public acceptance of plastics in handbags, curtain materials, sports goods and many other domestic items. For the difficulties at present applying mainly in the thick sheet field may well spread to include thin sheeting.

Dumping

THE problems that require solution are many and complicated enough when considering our own internal affairs. If the matter becomes international, includes Germany and countries to the East with lower standards of wages and far longer hours of working resulting in different standards of living, and deliberate Governmental subsidies for exports, then we are faced inevitably with all the pre-requisites for " dumping." At a time when our own production methods are generally exceptionally efficient, it is intolerable that we should have to submit to pressure because one or more of the above conditions, especially that of subsidies, exist in other countries. These conditions must be examined closely and if necessary the proof of " dumping," which we presume is primarily defined as " sale abroad at a price lower than that at home," clearly exposed.

We must look to our own faults also, for the rising spiral of our costs through rising wages continues unabated with no material benefit to anyone. It is perhaps significant that following the recent strike in Poland, the Prime Minister of that country announced that no increase in wages could take place. Who knows we may yet see " dumping " from Poland which has always had quite a lively plastics industry. If such things can happen without Government intervention, how shall we fare in any European Free Market ?

Glass/Resin Structures

ONE of the most encouraging pieces of news in the field of glass-fibre resin reinforcements we gave in our August issue; two British companies have begun the production of resin/glass pre-mixes for use with matched moulds.

To stress the value of this movement we have pleasure, in this issue of the journal, in publishing two important articles on this very subject: one from America and the other resulting from a visit to the works of a British company, which shows very adequately the high quality and speed of production attained.

In the case of the Chrysler company of the U.S.A., we have the information (already told us by Mr. Joseph, of Ashdown's Ltd., at the Harrogate Convention) that 26,000 heater units for the Chrysler cars are being thus produced each year and that the total consumption of pre-mix in the factory is of the order of 26 tons a day for all the different units made.

In the case of British Moulded Plastics Ltd., the " mass " production of washing machine tubs of considerable size is equally exciting, while the layout of the new buildings for the job is a credit to the company and a consolation to us.

MOULDING POWDER AND SHOT

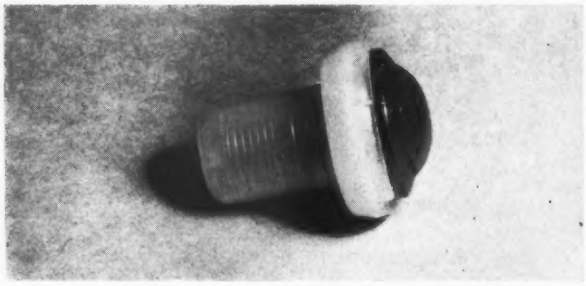
Most of us remember the Cresswell Colliery disaster a few years ago, where a rubber coal conveyor band caught fire with tragic results and so started the widespread conversion to p.v.c. conveyor belting. We are reminded of other fire hazards and a seemingly necessary replacement of the old type of tarpaulin made from polymerized linseed oil-coated fabric. A serious accident at Paddington station was recently reported as having started because a tarpaulin sheet, employed during roof repairs to protect the platforms, caught fire with the result that burning debris fell on to a number of railway coaches and damaged them seriously; firemen were continually in danger from glass falling from the burning roof. If the tarpaulins were of the old type it is high time they were replaced by the now-available non-inflammable kind made from p.v.c.

Guard Against Fire

* * *

There's nothing like cork—how true ! But for several years now in France there's been a bit of a war on to get polythene stoppers into the champagne trade to replace the cork type. The moulders have got as much chance as a snowball in hell to overcome the conservatism of the growers in the Champagne country, but at least they've got into champagne's poorer relationships, that bubbly stuff that you get at certain country weddings, children's first communions and birthdays—sparkling muscatel. Here's a sample of such a stopper I pocketed recently at such a show and an excellent

When's a Cork not a Cork

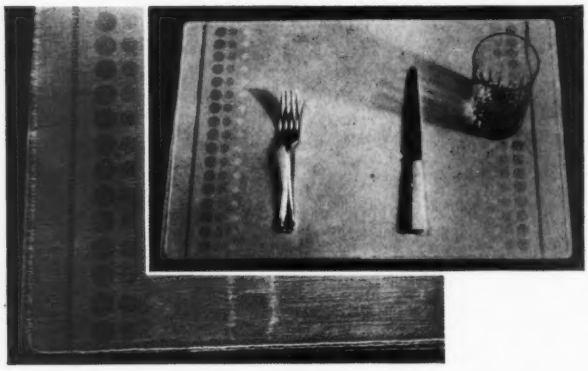


job it is—a simple hollow moulding of polythene, the top being closed with a transparent, red coloured press-in polystyrene lid. Extremely efficient, the stem is 19 mm/o.d. and 16 mm. i/d. giving a thickness of $1\frac{1}{2}$ mm of polythene—very tight and very strong. Ridges on it give it additional tightness. British moulders won't ever get a chance for this business but Australians should look into the matter and so should everybody for the good class cider and the vinegar trades. And of course if you're swimming the Channel this year you can always secrete a few about you for added buoyancy.

* * *

During the Exhibition I had a chat with Mr. A. T. Honnor of the Fethaware Division of Fraser and Glass Ltd. about the p.v.c.-covered damask linen tablecloths I saw in Calvi during my holidays. He has just sent me a remarkable sample of a plastic table mat made, he believes, in the U.S.A., although he picked it up in Holland. It is remarkable for the fact that it is moulded with supreme accuracy, indeed we think using a real linen mat for the mould, for it looks like hand hem-stitched linen. It is, however, wholly p.v.c.

First Class Moulding

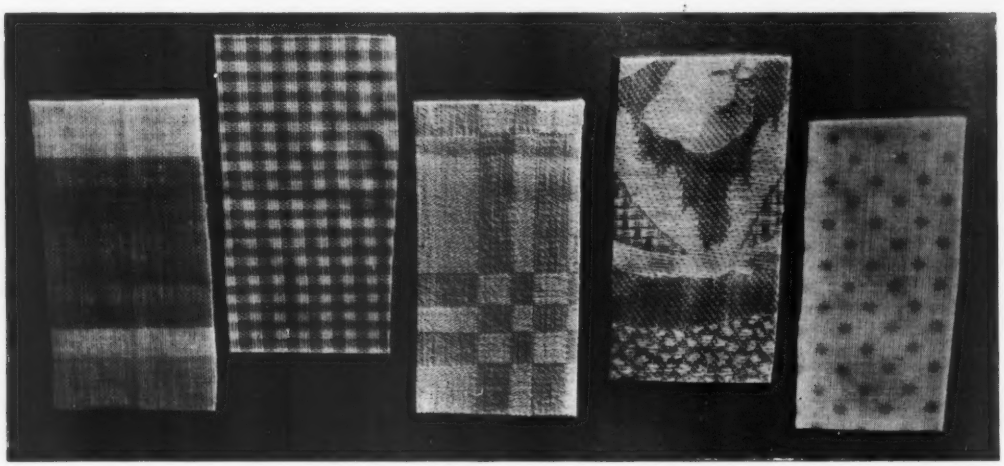


* * *

Much more to my point, I have just received a letter (see the " Letters to the Editor " page) and samples from G. F. Parkinson and Partners Ltd., Lancaster. The samples shown below are the real thing and are exactly what I saw in Corsica: a transparent p.v.c. or similar coating on linen—one side only is treated. The colours are of course the colours of the linen weaves. The effect, as I have said, is amazing and will warm every housewife's and restaurateur's hearts. But what a shame that the textile people are so hesitant about coming into this exciting game, or alternatively that our own calendering and coating companies do not start and open up this new and, I feel sure, rewarding field of higher quality and higher prices.

But this is the Stuff!

DOGSBODDY.



Samples of table covering treated with p.v.c. on one side. Left to right: cotton (coloured stripes on white); linen (red checked); white damask linen; green damask linen; red polka dot design on cotton.

Resin-Glass Moulding in Practice

The tub for the Vactric washing machine is now in production at British Moulded Plastics Ltd. Moulded by the matched-metal die process, both the tub design and moulding procedures involve many interesting points. This article descsribes a recent visit to the factory.

Fig. 1. The Vactric tub

MORE attention has probably been devoted to polyester-glass materials in the past decade than any other. Despite unlimited enthusiasm, tonnage production of resin failed to give credence to the theory of a rapidly expanding new branch of the plastics industry. Until, that is, development work commenced in the matched metal die moulding of these materials. Then, in Britain at least, some progress was made, notably with the crash helmet for motor cyclists and aircraft battery boxes.

Now, tangible progress is apparent, and one of the first big-scale applications for this technique is under way at the Walthamstow factory of British Moulded Plastics Ltd.

The Vactric Company, in preparing designs for its new washing machine, sought a number of important characteristics in the material to be used for the tub—the vital portion of the machine. These were corrosion resistance, both to water and detergents, impact strength, against accidental damage, and lightness in weight. After considerable research, the possibility of using resin-glass was considered, since this material would fulfil these requirements. In addition, resin-glass would permit a shape to the tub which would be unobtainable in pressed steel, due to the complexity of the contours, as can be seen in the illustration above.

The resin-glass department of British Moulded Plastics was approached with a view to the eventual placing of a contract. This department had already been in existence for sometime and had gained considerable experience in the matched metal die moulding process. It was thus possible to prepare prototypes for Vactric which indicated quite clearly that the revolutionary design of the tub was well within the capacity of the material and process.

During a recent visit to British Moulded Plastics Ltd. we were able to see the production facilities for the tub. The process

Fig. 2. The operator is seen here spraying the emulsion on to the preform in the Brenner preforming machine.

Fig. 3. Removing the preform before placing in oven to dry off its emulsion. On the right is a dry preform.

commences with the Brenner preforming machine into which rovings of E glass are fed from a cheese mounted on top of the machine. The Brenner preformer, which is made in America, has twin turntables of the shuttle type and the preforming unit rotates whilst the chopped rovings, some 2 in. in length are sucked down on to the perforated metal former.

Accuracy in the manufacture of the preform is essential since even minor errors in the application of glass to the former would result in poor mouldings.

The preform is then sprayed with a polyester emulsion (see Fig. 2) to bond the rovings together after which it is stoved to remove the water. Some 5 to 8% by weight of the glass content, of emulsion is applied. The weight of glass used for each preform is 2¾ lb. The oven treatment is carried out at 400° F. in a gas heated Brenner unit.

Resin Compounding

Adjacent to the moulding shop is a compounding room of some 20 ft. × 30 ft. This room contains a range of Cruickshank mixers of the conventional paddle blade type. Here also the raw materials are stored, polyester resin, catalysts, fillers, pigments and cross-linking agents.

Experience at British Moulded Plastics has shown that accurate weighing of ingredients and proper mixing are essential if high production runs at good quality levels are to be maintained. Weighing of small constituents is therefore carried out in grams upon accurate balances.

The filler employed with the B.I.P. Laminac resin is precipitated calcium carbonate. Benzoyl peroxide is employed as the catalyst.

Chromium plated cast steel tools are employed for the manufacture of the tub. Bipal low pressure presses are installed, moulds and platens being steam heated.

Moulding Procedure

After applying a releasing agent, an overlay mat of slightly more porous structure than the chopped rovings is placed over the punch which is clamped in the press bed, and the preform superimposed. The resin compound (7 lb.) is then poured on to the top of the assembly as shown in Fig. 4 and the press is closed. A pressure of 500 p.s.i. is developed and a cure time of four minutes is allowed.

Temperature control on the press is held to very close limits since only great accuracy will permit the production of high quality products. A slightly higher temperature is maintained on the punch than the die to draw a certain amount of resin through the overlay to provide the fine surface necessary on the working area of tub.

The wall thickness on the tub is 0.093 in. overall and after moulding a number of finishing operations are carried out. A thin web of resin flash runs round the top of the periphery of the tub which has to be removed by means of an emery buff. Due to the cut-off in the mould, this web is extremely thin, leaving the minimum amount of exposed glass possible. In the finished form, this part of the tub is totally enclosed by a chromium plated wrap-round trim.

Finally, various holes are punched for the mounting of control knobs, wringer, drain plug and agitator. These holes are rubber bushed, again sealing-off any exposed glass.

In addition to the tub, a flat splash cover is moulded (seen in position in the photograph of the tub overleaf) from chopped strand mat and a surfacing tissue. The same resin compound is employed ensuring uniformity between cover and tub. A stage in the production of the splash cover is seen in Fig. 6.

Over 8,000 tubs have been produced to date and the production rate is shortly to be increased. Here, therefore, is more than

Fig. 4. The preform in position in the press. The operator applies its resin prior to moulding.

Fig. 5. The operator is seen here removing the finished moulding from the press.

adequate evidence of the successful manner in which British Moulded Plastics have developed the match metal die moulding technique for large structures. It also demonstrates that resin-glass products properly moulded can meet high quality specifications in a high priced commodity such as a washing machine.

Cost Analysis

The cost analysis on the resin-glass tub indicates that it is roughly 50% more than the price of a metal pressing. This figure is derived from a basic price of 4d. per lb. for painted metal as against a rough figure of 4s. per lb. for self-coloured resin-glass. Economy in production rates, however, plus the fact that the resin-glass has a specific gravity one seventh that of steel, reduces the apparent advantage that painted metal may otherwise appear to have. In addition, the shape of the Vactric tub could not in fact be produced in pressed metal due to its irregular contours. The use of resin-glass therefore permits the designer far greater flexibility than traditional materials. This together with resistance to detergents and water corrosion, the moulding-in of the colour, the elimination of accidental chipping, the saving in weight, and the retention of heat in water, makes the resin-glass tub a very satisfactory proposition.

In this series production of the Vactric tub may well lie the break-through of the polyester-glass materials into the mass production field, which alone can give hope of a large scale tonnage absorption of resin and glass. British Moulded Plastics have demonstrated that by careful attention to all of the critical elements in the production cycle, large run mouldings can compete not merely with established plastics materials but also in many fields previously held by older established materials. Some idea of the scale of manufacture involved in the Vactric tub can be gained from Fig. 7.

Fig. 6. Pouring resin onto chopped strand mat prior to moulding the splash cover.

Finally, we are grateful to the management of British Moulded Plastics Ltd. for the facilities made available to prepare this report.

Fig. 7. A general view of a section of the resin-glass department at British Moulded Plastics Ltd.

Pre-mix Progress in North America

By A. LESSHEIM

The author, who manufactures and moulds pre-mix materials, reviews the current developments in the pre-mix field in the U.S.A. and Canada. Special emphasis is given to the motor industry, already absorbing large quantities of pre-mix mouldings.

THE purpose of this article is to outline the potential of pre-mix moulding compounds. No attempt is made to discuss formulations or performance, but that the figures quoted of present-day usage of pre-mix in North America will doubtless be of value to European readers interested in these materials. Experience in North America has shown that while pre-mix can be very profitable, it is essential that all the factors be evaluated and that any application be thoroughly studied.

What is Pre-mix ?

Pre-mix, formerly called " gunk," is a material which consists of resins, fillers, fibres (glass), catalyst, pigments, release agents and stabilizers. The type of resins, fillers, reinforcing fibres, catalyst, release agent and pigments used, as well as the percentages involved of each and every one of these components will, of course, affect the performance and behaviour of the finished moulded product. One must remember that the pressure, time and temperature must also be right. The reader will realize that the finding of the right combination can only be achieved by careful study of the application.

All these materials are mixed in a Sigma blade-type mixer and, when mixed to specification, are taken out of the mixer and, usually, put through a rather simple extruder, which compresses the mix as well as making it more manageable for the operator to use when moulding. The bulk factor of the mix on coming out of the Sigma mixer can be as high as 4:1, depending on the composition of the mix.

Process Control

The mixing time, method and temperature are also very important, for the present type of mixer used (Sigma blade) can and will break down the fibres (glass) if mixed too long. The temperature while mixing, must also be watched, as on it can depend the storage life as well as the curing cycle. The method of mixing is also very important as it can affect the time needed to achieve a good mix and if the fibres are put in too soon, then, of course, fibre breakdown is bound to occur. From this it will be seen that two identical material compositions can give two entirely different end products, insofar as mechanical performance is concerned, all by a simple alteration in the mixing procedure. When making pre-mix containing no glass fibre, then, of course, the problem does not arise.

The bulk factor after passing through the extruder will be between $1\frac{1}{4}$ and 2:1, depending on the relationship of its bulk factor prior to extruding. It is well to bear in mind that the bulk factor enters strongly into the picture when designing the mould, and whilst the material can be compressed by hand, eliminating the extrusion plant, it is nevertheless advisable to extrude when on mass production. The term " pre-mix " covers all types of mixes made by the above method using any type of resin (polyester, phenolic, epoxy and others), provided the resin is in a liquid state.

As will have been noticed, the final performance, mechanical, physical, electrical and chemical, depends on very many factors, and it is outside the scope of this report to consider all the factors involved. While pre-mix, like all other materials, has its limitations, it can be formulated to give performances equal to chopped strand mouldings. By increasing the relative thickness of the moulding, one can compensate for its rather lower mechanical strength. For example, where a $\frac{1}{16}$ in. woven cloth would meet requirements, one would have to go up to $\frac{1}{10}$ in. if chopped strand mat was to be used, and if pre-mix was to be considered, then one would have to go up to $\frac{1}{8}$ in. or $\frac{3}{16}$ in., depending on the formulation.

Pre-mix is a very versatile material and, while it will solve

Heater distribution duct for Chrysler.

Complete heater housing unit in premix moulded for the 1956 Chrysler range; Chrysler use some 26 tons of reinforced plastics a day.

many manufacturing problems, it will not solve all of them. Also it will permit the manufacture of a more economical product in many cases, as waste and scrap is eliminated, in addition to the fact that the price per pound of polyester pre-mix can be as low as 1s. 6d. (no glass content), or 4s. for a high grade first quality mix. While washing can affect the performance of chopped strand mouldings, similarly uni-directional flow can affect pre-mix, but care in mould design can help to overcome this to a certain extent. Only trials and tests will prove if the mix that has been formulated will meet requirements. The author understands that some of the British resin manufacturers are contemplating entering the pre-mix field and while they will only be able to carry stocks of standard grades, I am sure that for large applications they will be only too pleased to formulate a mix to meet customers' requirements.

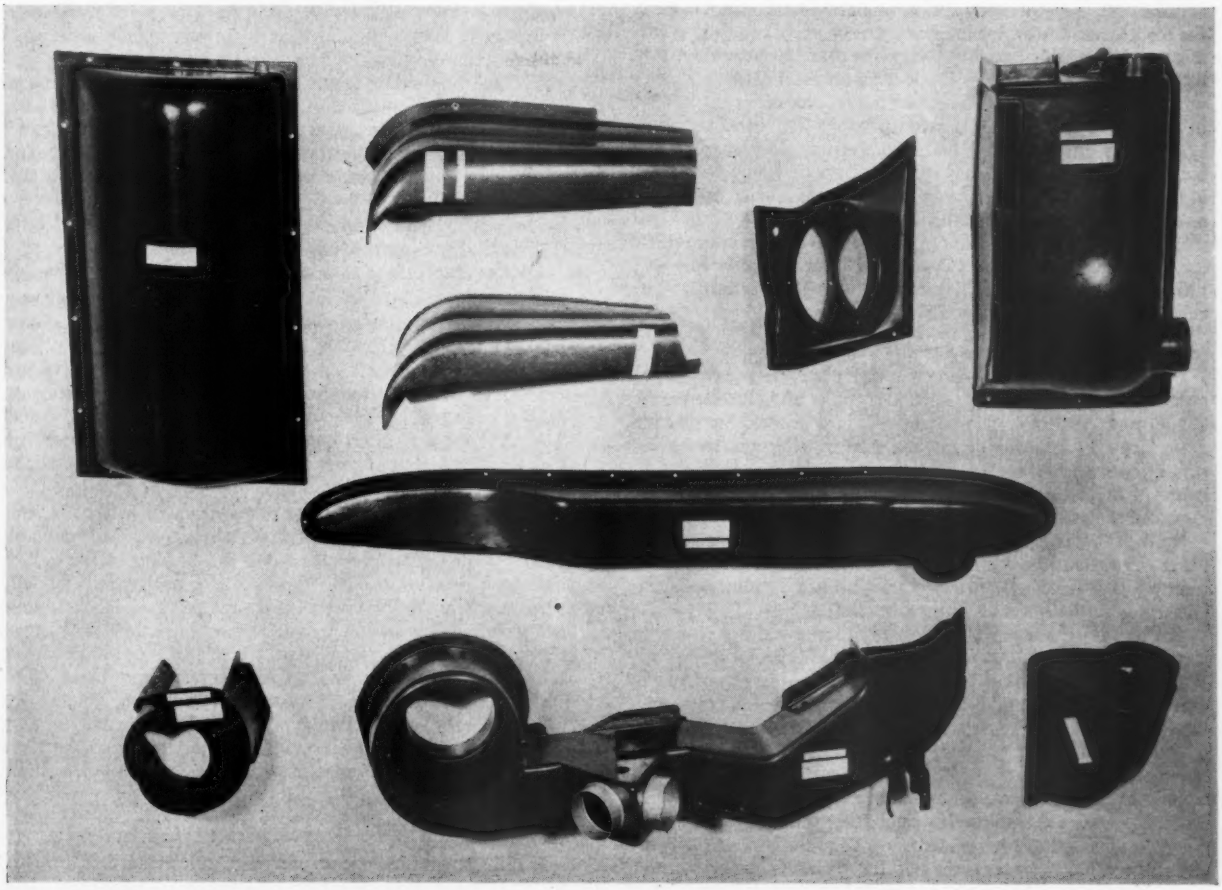
Applications

At the time of writing, the largest single user of pre-mix moulded products is the motor industry. The Chrysler Corporation, both in the United States and Canada, is at present using a heater housing on all its current models. This heater housing consists of four mouldings and their total weight comes to approximately 10 lb. The largest of these four has a total surface area of 650 sq. in., weighs 3½ lb. (last year's model weighed 5½ lb.). The average weekly production of all Chrysler models amounts to approximately 28,000 units. On this basis, there is a total weekly consumption of approximately 280,000 lb. of pre-mix on this one application alone.

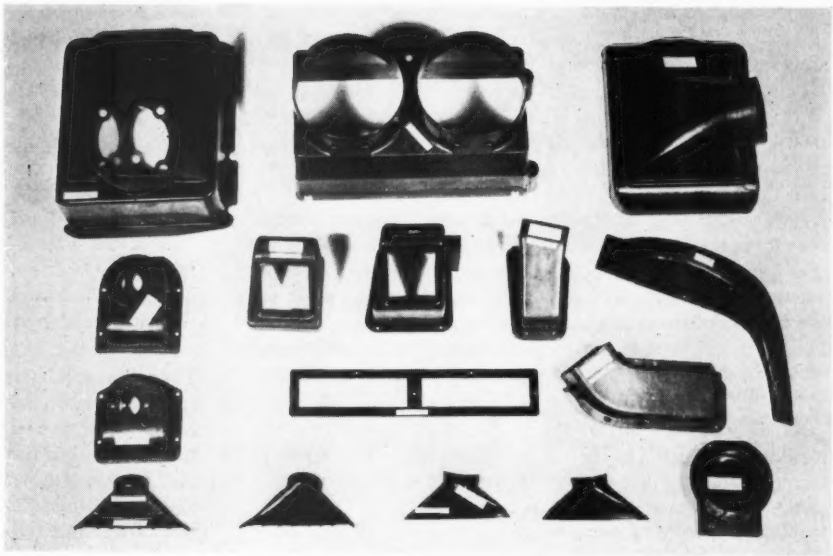
The author estimates that the motor industry as a whole consumes approximately 500,000 lb. of pre-mix mouldings per week covering all applications, e.g. outer decorative panels, ventilating equipment, kick panels, glove boxes and arm rests. In addition to this figure, many other industrial applications of pre-mix must be included, such as various heater and ventilating housing for industry and homes, air conditioning parts, speaker, radio, television and instrument housings, commercial body parts, electrical components and housings of various types. Therefore it might be said that the present total weekly consumption of pre-mix is somewhere around 1,000,000 lb. This covers only polyester pre-mix. Insofar as the other pre-mixes are concerned, little is known as to the quantity currently being manufactured, but it can be assumed that it is quite substantial and growing.

As to the future, one can only attempt an intelligent guess. The author understands that another of the big three motor concerns is at present planning to invite quotations for heater housings in pre-mix and if that materializes, together with a number of other jobs presently on the boards, then it is possible that by 1959 the total weekly consumption of pre-mix will amount to somewhere between 1,500,000 and 2,000,000 lb. It would be invidious to forecast how much of that will be polyester or phenolic or epoxy resin, for some severe competition between these three within the next few years is possible, provided phenolics can come down in cure time and expoxy resins in price.

In the long run it appears that pre-mix will capture part of the market for both thermosetting and thermoplastic moulding powders where the strength factor will be strongly in its favour. Also, it will take over a good part of the metal stamping field



Motor car heater parts moulded in pre-mix by Woodall Industries Inc.



A further selection of car components moulded in pre-mix by Woodall Industries Inc. The Chrysler Corporation is the largest U.S. user of pre-mix mouldings, mainly for car heater units. The plastic heaters give 8–10° more warmth than do the steel encased heaters normally employed, an important consideration in the North American winter.

where the component requires two or more pressings and subsequent assembly, and where pre-mix can meet the performance requirements. A lot of its growth will depend on factors such as appearance and surface finish, possible use of quickly and cheaply made plastic tools, high degree of quality consistency and, most important of all, the right applications of the material. This last-mentioned factor, as will be realized, is of the utmost importance because one bad application of a new material could cause a setback which could take years to overcome. There is the instance of a firm, eager to obtain a contract order for a pre-mix moulding, which quoted a very low price; this was achieved by incorporating next to no reinforcing fibres. Fortunately, they were not awarded the contract, but the repercussions could have been considerable if this inferior product had been accepted. Fortunately the customer had good testing equipment. The biggest enemy of the plastics industry is to be found within the industry itself, usually a newcomer who has little experience and is going into plastics either to diversify or in the belief that plastics are a short cut to riches. Most of the older concerns have learned by now that it pays in the long run to turn down a job, rather than to accept it when the outcome is doubtful. The customer appreciates this and will come back.

Progress and Development

In the United States, one can today purchase pre-mix compounds based on polyester, phenolic, epoxy and silicone resins. While most of these are made in standard grades, the pre-mix manufacturer (not always a raw material supplier) will make and supply compounds made to meet customers' specific requirements, provided the quantity justifies it and it is possible to meet the requirements.

On the other side of the picture, the pre-mix moulders who are using large quantities of pre-mix very often make their own. One example is Woodall Industries Inc. who are currently making and using not far short of 100,000 lb. daily.

The technique used to manufacture pre-mix is the well-known method utilizing the Sigma blade type of mixer. However, Woodall Industries who not only use more pre-mix than any other moulder, but also make their own mix, use at present a Ko-Kneader as well as Sigma mixers. I understand from them that the Ko-Kneader gives them every satisfaction. They can, however, only use the Ko-Kneader unit on compounds that contain no glass fibres as they would have fibre breakdown with this unit. From the above it would seem that provided one is going to manufacture large quantities of pre-mix containing no glass fibre, a Ko-Kneader is the solution. It is, of course, essential that with this type of mixer, one must use the right speed and feeding method, as otherwise instead of getting pre-mix, one will get lumps, slurry and generally unuseable material, because its variable consistency would give variable performance in the end product.

Reinforcing Agents

One of the most striking developments has been the use of sisal fibre in place of glass fibre, and some of the latest compounds contain no glass fibre at all. Many tons of such compounds are presently being used every day and have been for some time. Of course, strength requirements are not very high, but the point is it meets requirements. When strength is demanded, then glass fibre is incorporated up to 40%. Also, work on pre-mix containing synthetic fibre in place of sisal and glass is currently being carried out, and it shows great promise from an appearance point of view as well as mechanical properties. Given below is a typical specification for pre-mix containing no glass, but sisal and asbestos:—

Impact strength: Izod Notched, min. 1.5 ft. lb./in. notch
Flexural strength: Minimum 5,000 p.s.i.
Water absorption: 24 hours maximum 1%

At the actual moulding end, things are generally running very smoothly. The author knows of one plant that produced over 250,000 units last year with a total of less than 0.5% rejects. This was with a press closed time of 45 secs., total cycle of just over 1 min. All this was achieved without having a chemist, engineer or technician in the plant, but simply using general staff who, until then, had no experience with plastics whatsoever. One of the largest mouldings supplied in pre-mix has 6/7 sq. ft. surface area weighing 6 lb.

One of the main causes for the phenomenal growth of pre-mix on this continent can be attributed to the fast cure obtainable with polyester based pre-mix. This will be one of the factors phenolics will have to compete with. The author is personally acquainted with curing cycles of 40 secs. for a 3½ lb. moulding, having over 600 sq. in. in area and in parts ¼ in. thick, but knows of instances where 15 secs. was all that was used. The curing cycle required depends on flow and cure. Flow depends on viscosity of the resin, also pressure and speed of closing, as well as the whole formulation of the pre-mix. Cure depends on resin, fillers, temperature and time. Therefore, flow and cure are affected by pressure, temperature, time, speed of press and composition of pre-mix.

Acknowledgments

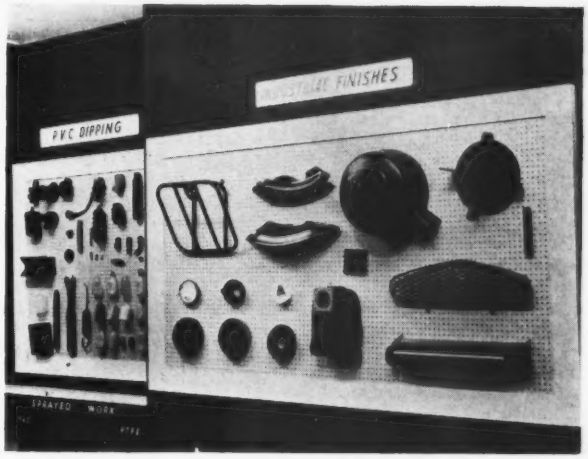
Grateful acknowledgments are made to Dr. A. C. Carter, of Chrysler Corporation, and Mr. J. Gregg, of Woodall Industries Inc., for their courtesy in furnishing some of the data quoted.

The British Plastics Exhibition

The following pages conclude the exhibition report, the first part of which was published in the August issue of "Plastics," pages 291-335

NITRILE rubbers and latices, marketed under the trade name Hycar, were an outstanding feature of the display of **British Geon Ltd.** The Hycar range of oil-resisting synthetic rubbers, copolymers of butadiene and acrylonitrile, provide a material for every nitrile rubber application. These rubbers are used extensively as seals, o-rings, u-rings, grommets and gaskets in mechanical engineering components, as oil and fuel hoses, adhesives and many other applications calling for outstanding resistance to oils and solvents. As latices they find use as leather finishes, pigment binders, textile adhesives and for the impregnation and coating of paper. In the rubber range, Hycar is marketed under the series numbers 1001, 1041, 1002, 1042, and 1043. These series numbers indicate whether the material is a high acrylonitrile copolymer, a medium-high acrylonitrile copolymer or a medium-low acrylonitrile copolymer. Specific gravity for the series is in descending order, 1.0, 1.0, 0.98, 0.98, 0.97. Thus 1001 and 1041 are employed for oil-well parts, fuel cell liners, fuel hose and other uses requiring a high degree of resistance to aromatic fuels, oils and solvents. 1002 is employed for shoe soles, kitchen mats, sink tops, printing rolls and other applications requiring good oil resistance. 1042 has similar applications to those of 1002. 1043 is employed for applications where improved low temperature properties are necessary.

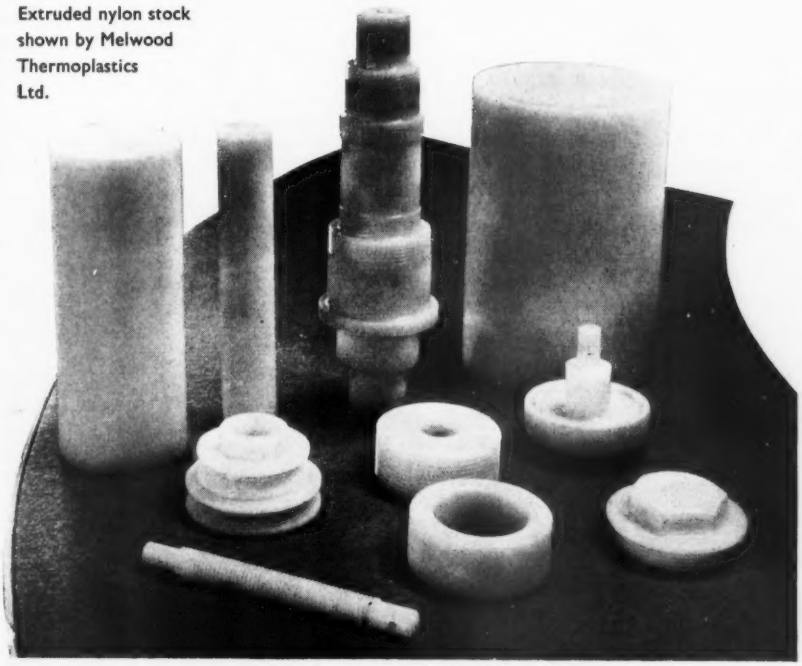
The Hycar nitrile latices are marketed also under the series of numbers, 1551, 1561, 1571, 1562 and 1577. The first three of these are high acrylonitrile copolymers, the last two being medium acrylonitrile copolymers. 1551 is employed as an adhesive, for modifications of phenolic emulsions and coatings where high oil resistance is required. 1561 is used for leather finishes, pigment binders, paper saturation, textile sizing and finishing and for tough abrasion resistant coatings. 1571 is employed for adhesives, coatings, leather finishes and can be cured to provide high tensile strength. 1562 finds also application as leather and textile finishes, paper saturation, and printing pastes, phenolic resins modification and adhesives. 1577 is a special latex providing very high uncured tensile strength for paper coatings, leather finishes, paints and blends with other Hycar latices.



A portion of the display by Durable Plastics Ltd., showing many items finished or dipped in plastics materials.

Cornelius Chemical Co., Ltd., featured their Versamid range of polyamide resins. The resin is prepared by the condensation of polymerized linoleic acid with polyamines and is available in a number of grades. In conjunction with epoxy resins certain Versamids can be converted into thermosetting compounds to yield a range of end products from soft resilient materials to hard strong resins. They have excellent adhesion to most materials and surfaces, and are used as general and structural adhesives. Plastic tools and dies are made from epoxy/Versamid resins eliminating the use of toxic amine-type curing agents. Versamid is the trade name of the Chemical Division of General Mills.

The North British Rubber Co., Ltd., were showing examples of formed products from Royalite which has been developed by the United States Rubber Co. and is now being produced in this country. Royalite is a butadiene acrylonitrile and styrene acrylonitrile compound which can be formulated to give both rigid and flexible sheets. It has a softening temperature of over 240° F. and can successfully be vacuum formed. Although comparatively unattractive in appearance it can successfully



Extruded nylon stock shown by Melwood Thermoplastics Ltd.

Resin-glass ducting manufactured from reinforcement produced by Marglass Ltd.

be laminated to a majority of thermoplastic films and the examples shown on the stand were treated in this way. Motor car trims, suitcases, Tote boxes and other applications were shown.

Polythene was one of the materials featured by **Bakelite Ltd.** Marketed in a range of grades, Bakelite polythene has been the subject of a number of information sheets issued recently.

In the extrusion field, grade PN.400 has been designed specifically for the manufacture of high-quality black tube. Tubing made from this grade possesses a considerable combination of properties including excellent chemical stability, toughness, natural flexibility, and resistance to water, many chemicals and the effects of freezing. The compound is formulated in accordance with B.S.1972:1953.

Extrusion conditions embrace a temperature range on heaters from 130 to 145° C. The maximum working temperature recommended for tubing is 60° C., softening point being approximately 90° C. Elongation at break is 450%.

Another extrusion grade, PN.201 is a cable dielectric material containing 0.5% by weight of lead naphthenate as an ant repellant. Higher processing temperatures are required than for the grade mentioned above ranging from 140 to 200° C.

Technical memorandum issued by Bakelite, number D.104, reprinted in June, 1957, is an especially valuable pamphlet giving fundamental information on extruded Bakelite polythene.

Amongst other materials featured by Bakelite were the epoxide resins and p.v.c. compounds. The epoxide resins were discussed in the August issue of *Plastics*, page 310, and photographs of tooling made with these materials are shown on the following pages. Bakelite also showed a beautifully produced sailing dinghy in glass fibre bonded with Bakelite polyester resin.

In addition to the transfer moulding p.v.c. compound type H.Y. shown by **Vinatex Ltd.** (page 304, August issue of *Plastics*) the company also showed an extensive range of compounds designed for extrusion, for calendered and pressed sheets, for slush moulding and for dipping.

The Vinatex display was designed to emphasize the wide range of applications which these materials enjoy. Of particular interest was a pamphlet dealing with the Vinatex colour matching service, enabling the company to match and supply Vinatex colour concentrates and colour compounds, for extrusions, injection and transfer mouldings to meet the most stringent colour specifications.

The Vinatex polyvinyl alcohol compounds were also displayed.

The slush moulding pastes manufactured by

Diothene polythene film shown for food packaging by the Metal Box Co. Ltd.

the company, used for the production of flexible hollow toys are also employed for industrial applications. Dipping pastes are also being supplied for coating, flock spraying, flexible mouldings, oil resistance applications and for epoxy and polyester castings.

The wide use of synthetic resin outside the plastics industry was exemplified by the display of **Vinyl Products Ltd.** examples and photographs of the finished product in which their resins were used included samples from the surface coating, textile, building, tanning, and paper industries to name only a few. The resins used are based on polyvinyl acetate, polymethacrylate, polystyrene and a wide selection of copolymers.

The **Metal Box Co. Ltd.** made a special feature of Diothene film for food packaging, as seen in the photograph on this page.

A plastic suit of armout, which has been recently introduced by J. & L. Randall Ltd. into their Merit Toys range, was displayed by **Iridon Ltd.** The helmet and visor, breast plate and shield is vacuum formed from silver Iridon-1000 polythene sheet. This metallic colour gives a genuine steel look to the toy armour.

Demonstrated on the stand of Bakelite Ltd. was the Hypak sealer marketed by the **Oppenheimer Casing Co. (U.K.) Ltd.**, designed for sealing polythene bags, etc. Production rates of up to 500 bags per hour can be obtained and wells of up to 15 in. wide are possible.

The Plastics Division of **I.C.I. Ltd.**, showed the complete range of materials manufactured by the company. In addition to the Melinex polyester film, described in the July issue of *Plastics*, page 245, phenolics, ureas, polyesters, p.v.c., p.v.c. copolymers, acrylics, polythene, nylon, and p.t.f.e. were featured. A full account of the manufacture, processing and applications of p.t.f.e. was published in the April issue of *Plastics*, pages 113/121. Butakon materials created special interest. A range of copolymers of butadiene with a variety of other monomers such as styrene, methyl methacrylate, and acrylonitrile, the Butakon materials vary in character from rubber-like materials to hand resins. A fascinating range of properties is obtainable with these materials. One interesting example is shown overleaf, the Butakon S material containing over 50% of bound styrene, used in the manufacture of soles for childrens' shoes. The photograph shows a group of children giving the soles some really hard wear.

Cosmocord Ltd., showed many mouldings carried out for the trade, including components for the B.B.C., Phillips Electrical, Morphy Richards, Sictaphone, and many other well-known companies.

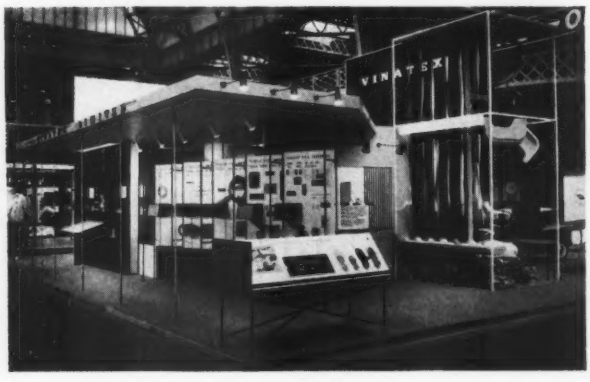
A new antistatic filler Omya AST which is not at present commercially available in this country, was shown. This material when used in gramophone records reduces static up to 75%, without producing background noise, it can also be used to produce p.v.c. tubing for the conveyance of dry materials. Omya BSN can be used in p.v.c., it improves the properties and reduces costs. Due to the small and regular particle size of the Omya materials they can be used as a reinforcing agent in natural and synthetic rubbers. Another new material, which will be on the market early next year, Omya BLP, for hard white polyester mouldings, was displayed (shown by **Croxton and Garry Ltd).**

Fibre mouldings of various types and sizes were shown by **Prestfibre Ltd.** Industrial containers and travel goods were shown as examples of these mouldings. Pimfibre process incorporates 20% of a resin binder. Television backs, assembly trays, etc. are made from this material. An interesting feature on the stand of Prestfibre Ltd. was examples of electroplating of copper, nickel or chromium on to plastics by the Metaltreat process.

An interesting new material and mouldings made from it was shown by the **Mycalex Corporation of America.** This material, known as Supramica, is glass bonded synthetic mica. The mouldings are manufactured by a transfer process having first preheated the pallets to a high temperature. Exceptional electrical properties and dimensional stability are two features of these mouldings. They also are capable of being used continually in temperatures of up to 500° C. The examples shown included a radome for a guided missile, electronic and computor parts and radar components. The thermal expansion of this material is approximately the same as that of steel and in consequence the moulding of inserts is a comparatively simple process. Supramica has a specific gravity of 2.8 and is unaffected by irradiation.

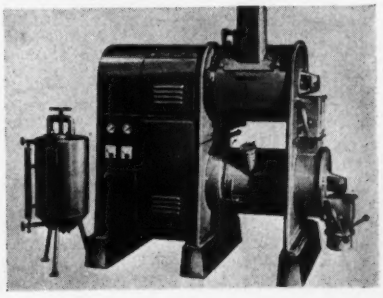
As examples of the end products of **Tufnol** laminated material a track on a cable layering machine were shown. Other products included gear wheels, bearings and pipe joints.

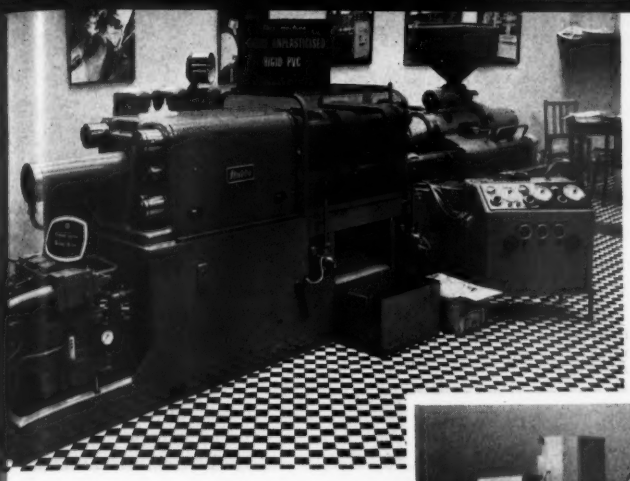
On the three following pages are shown stand photographs, and others illustrating the materials and applications shown at the Exhibition.



(Left) Stand of Vinatex Ltd., at the Exhibition.

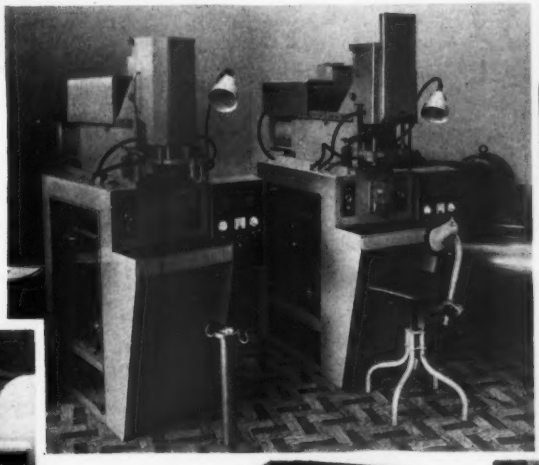
(Right) Lodige-Morton mixer type FKM.150. D.K., shown by the Morton Machine Co. Ltd.



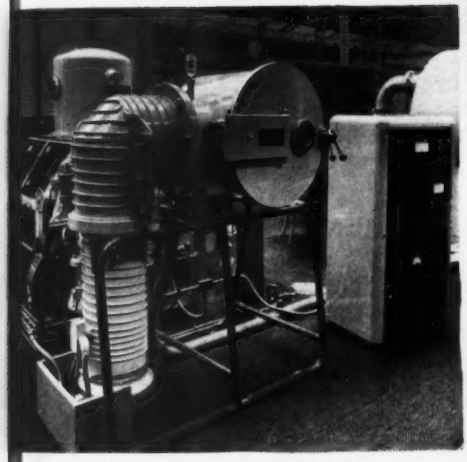


(Left) The Stübbe injection moulding machine shown by F. J. Edwards Ltd.

(Above) Radyne W.29 two pillar pneumatically operated press welders powered by a Radyne 6 kW. generator.

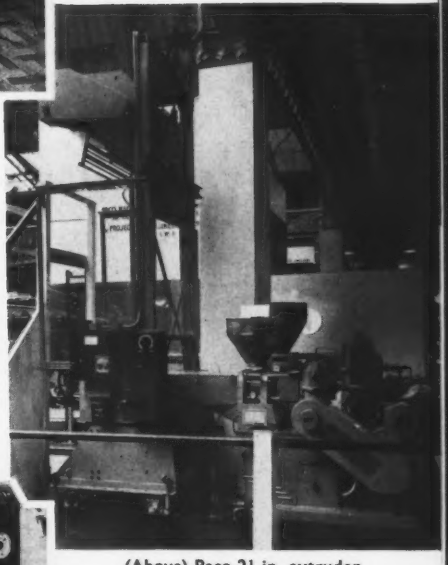


(Right) Timatic injection moulding machines on the stand of B.L.C. Exports Ltd.



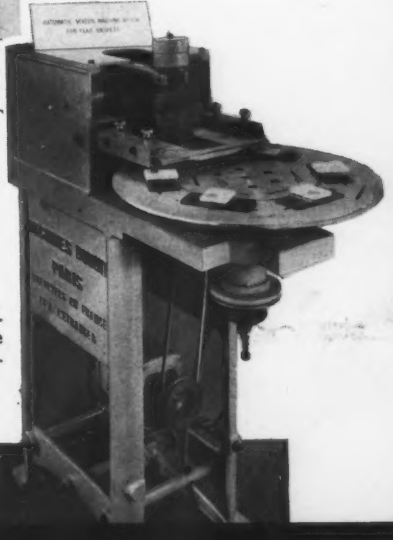
(Above) The new vacuum coating plant shown by Vacuum Industrial Applications Ltd.

(Right) The Daniels 20-ton Alkyd moulding press.



(Above) Peco 2½ in. extruder and film take-off equipment.

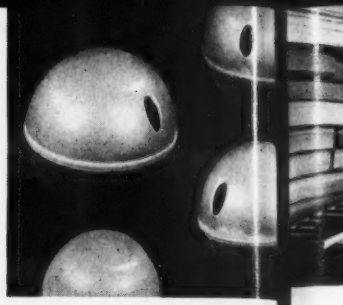
(Left) The new Baker Perkins 3½ in. extruder.



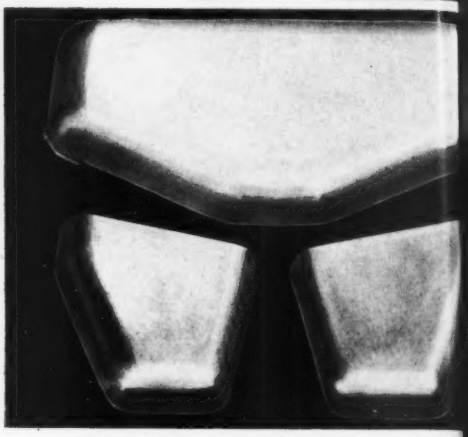
(Right) The Dubuit automatic screen printing machine shown by Kemitype Ltd.

(Right) Styrocell expanded polystyrene and vacuum formed high impact polystyrene on the stand of Styrene Products Ltd.

(Right) Danish trawlnet floats moulded in Erinoid specially modified high impact polystyrene.

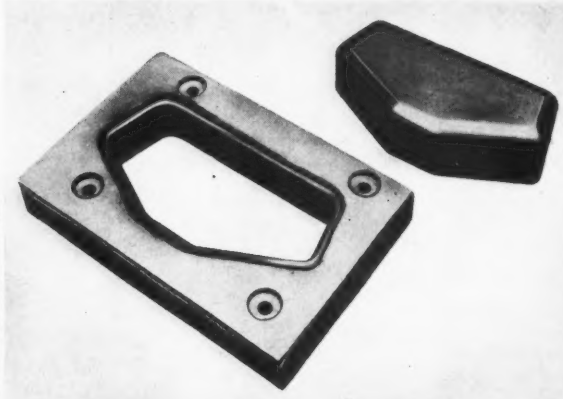


(Left) A Revell Authentic Kit precision moulded in Styron 666 manufactured by British Resin Products Ltd.



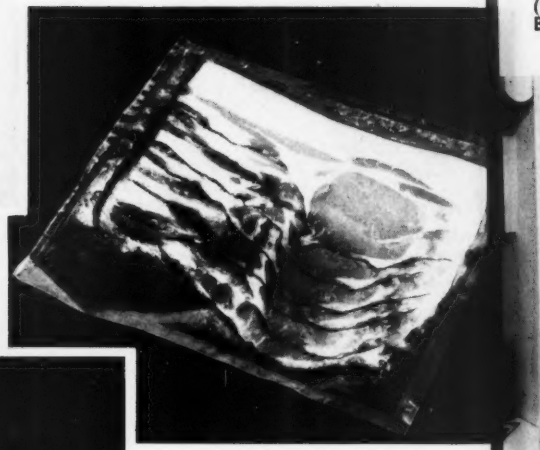
(Above) 20 gauge steel pressing, by Surrey Steel Components Ltd., made with epoxide tooling employing Bakelite Ltd. resin.

(Below) lucent purpos



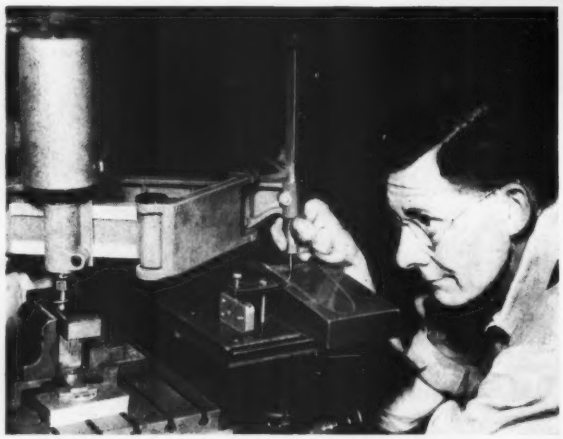
(Above) Punch and die for metal pressing (Surrey Steel Components Ltd.). Punch is made with Bakelite epoxide resin.

(Above) Hoover vacuum cleaner with motor body cover moulded in Erinoid C.P.20 high impact polystyrene. Also dirt finder lens in Erinoid high acetyl cellulose acetate.



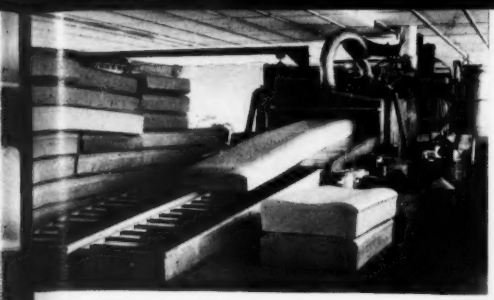
(Above) I.C.I. Melinex film shown here to package bacon.

(Below) All-plastic greenhouse developed by British Industrial Plastics Ltd., and shown at the exhibition.



(Above) Pantograph model made by Dorking Foundry from Bakelite epoxide resin.

(Left) Ladies' shoes with heels moulded in Erinoid C.P.20X special high impact polystyrene by John Prior Engineering Limited.



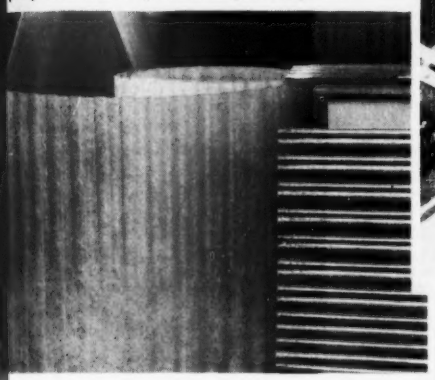
(Left) The manufacture of Polyurethane foam material shown by Leslie Gordon Ltd.

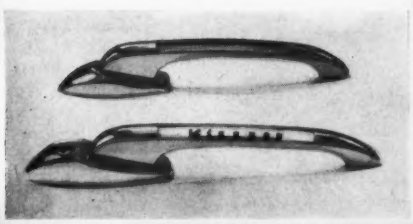
(Right) Children's shoe sales made from I.C.I. Butakon, under trial.

(Left) Large mouldings shown by National Plastics (Sales) Ltd.

(Below) Kolster Brandes portable radio with mouldings by Injection Moulders Ltd. in Erinoid polystyrene.

(Below) Corrugated polyester-glass translucent sheeting for roofing and other purposes shown by S. Miller (London) Ltd.





(Right) Pullout handles shown by Wilmot Breeden Ltd.

(Left) On the stand of the Department of Scientific and Industrial Research.

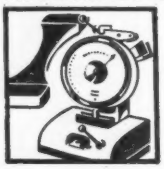
(Above) Stand of the Tellus Super Vacuum Cleaner Ltd.

(Above) Factory equipment shown by H. C. Slingsby Ltd.

(Left) An L.C.C. ambulance, the coachwork of which is made with the aid of Beck, Koller & Co. (England) Ltd. polyester resin.

World's Industry Employs Plastics

MATERIALS and TESTING



Fungi and plasticizers.—The ability of various fungi to use as organic neutrants the plasticizers contained in resin formulations is discussed in this article. The report contains tabular information on the ability of different compounds to serve as carbon sources for 24 species of fungi. Included in the compounds listed are enlarged groups of commercial plasticizers, a homologous series of adipates and related compounds. Some of the conclusions reached show that diesters of saturated, aliphatic dibasic acids can be utilized by fungi, if they contain 12 or more carbon atoms. The maleates are fairly fungus-resistant and the alkyl derivatives of phosphoric and phthalic acids do not serve as carbon sources for fungi. The polyhydric alcohols can be used by fungi, if the hydroxyl groups are on adjacent or end carbon atoms. An ether linkage into the carbon chain decreases ability to support fungus growth.
(*Ind. & Eng. Chem.*, 1957/July/1115.)

Epoxy resins.—A series of articles on the use, manufacture and chemical behaviour of epoxy resins is published. The 35 pages covered in this survey provide one of the most comprehensive published works on these materials.
(*Ind. & Eng. Chem.*, 1957/July/1079.)

Dyeing of synthetic resins with modified acid dyes during polymerization.—A method of modifying textile dyestuffs to enable them to be used for dyeing plastics in a wide variety of pleasing shades is to employ acid dyes of suitable type in the form of the salts of quarternary basis containing a higher alkyl group. Unlike the sodium salts of the same acids these compounds are insoluble in water but readily give stable suspensions in certain monomers such as styrene, methylmethacrylate, in phenolformaldehyde and epoxy resins before curing and in unsaturated polyesters prior to complete polymerization. They give strongly coloured clear suspensions in most cases although black dyes mostly give mere dark tones. Their presence does not affect rate of polymerization or curing time and they are not in most cases affected by benzoyl peroxide. Z. K. Jelínek of the Research Institute for Organic Synthesis at Pardubice-Rybitví gives a simple method of preparing these substances and indicates those acids dyes most stable for the purpose. They are characterized by the presence of minimum polar groups in the molecule. Dyestuffs with two or more sulpho groups lead to products not capable of sufficiently stable suspension or solution in the monomers. A suitable quarternary base consists of the condensation product of stearic acid and lauryl chloride, which is already in use as a plastizer in the textile industry.
(*Plaste und Kautschuk*, 1957/June/209.)

Production of ozone for water sterilization.—In a paper presented by P. Guinvarch to the International Ozone Congress in Chicago in November, 1956, a detailed account is given of the large scale preparation of ozone for the purification of the mains-water supply in Paris. Preparation of ozone at an economical cost requires the use of "conditioned" air, in particular a reduction of humidity; this is attained by refrigeration, and in the tubes of a heat exchanger in the air cooling plant, moist ozone has a tendency to cause marked corrosion which has not been satisfactorily prevented by coating the tubes with oil. It appears, however, that the rate of corrosion can be diminished by protecting the tubes with paints based on synthetic resins of high molecular weight. The author notes that a prolonged test period will be required to confirm these results. It is also observed that, to guard against the dangers of accidental inhalation of high concentrations of ozone, workers in the neighbourhood of the ozonizers are provided with Neoprene masks.
(*L'Eau*, 1957/May/102.)

INDUSTRIAL APPLICATIONS

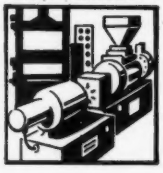
Trans-European Diesel Express.—A detailed account is given by Leicher of the kitchen and dining cars of the TEE trains operated by the German State Railways. Much of the construction of these is in aluminium alloy but special reference is made to important uses of "Remanit" which is employed to cover the working surfaces of numerous tables in the car. For example one working table runs the whole length of the buffet car and on this is mounted glass-cleaning apparatus with hot and cold water services. The Remanit here maintains its excellent finish. Similarly, the working table in the bar is also covered with this material and likewise the tables in the kitchen.
(*Eisenbahn Technische Rundschau*, 1957/May/174.)

Plastic floor covering of Austrian origin.—Under the name "Terravinyl," a p.v.c. based floor covering has recently been developed by the Oesterreichisch-Amerikanische Gummiwerke A.G. of Vienna. Apart from its more obvious properties, the non-soiling qualities of the Terravinyl surface are commented upon as is also its property of not promoting condensation of atmospheric moisture. It has a high sound damping capacity and high electrical resistance. It is not attacked by any ordinary acids or alkalis and is not affected by petroleum and aromatic hydrocarbons and oil. It is marketed in a thickness of 2.5 mm. in sheets 1 m. by 2 m. It may be fixed down to smooth concrete surfaces by means of p.v.c. base adhesive but, if the concrete surface is in direct contact with the earth, an interposing layer of some water repellent sealing agent such as bitumen must be provided. For household use the material is obtainable with a textile backing under the name Terravinyl-Tex. Against a standard abrasive test, Terravinyl is nearly three and a half times more resistant to wear than rubber and nearly five times as wear resistant as linoleum.
(*Bau Allgemeine Zeitung*, 1957/April/36.)

Preventing food contamination.—In the course of an exhaustive and critical account of technical problems in maintaining cleanliness during the handling of meat through the various stages up to the point of retailing, Brevot notes that in the U.S.A., meat products at the retailers may be held in open deep-freeze units if wrapped in cellulose-base film ("Cellophane") but that if unwrapped, then the glazed deep-freeze unit must be kept closed.
(*La Technique Sanitaire et Municipale*, 1957/May/128.)

Cast epoxy insulation.—An article by D. E. Crawford discusses cast insulation systems to improve the design and performance of electrical and electronic components. The author has taken a small motor stator as an example and goes through various stages which led to a decision to use a cast insulation in preference to a varnish. The casting processes are also reviewed and the reasons why vacuum casting was finally selected given.
(*Materials in Design Engineering*, 1957/July/99.)

PROCESSES : MACHINERY



Spin welding of plastics.—A new method of welding circular containers especially aerosol bottles moulded in nylon, polythene, or acrylic is described. One plastics part is held stationary in a special adapter while the other part is rotated against it. Frictional heat causes a melt to occur and weld takes place. When the weld is completed both halves are allowed to rotate. The process has been developed by Du Pont's Sales Service Laboratory.
(*Materials in Design Engineering*, 1957/July/174.)

MISCELLANEOUS USES

Plastic ramrod for use with explosives in mines.—The Paul Zeunert Company of Essen-Werden has been manufacturing for some years now special ramrods for use with explosives in mines. These are made from tubes in the p.v.c.-base plastic "Astralon." Previously these had a wall thickness of 2 mm. which, however, proved insufficient and has now been increased to 3 mm. The working end is closed with a solid plug of Astralon which may be replaced when worn. Unlike their hardwood counterparts, the plastic ramrods are very flexible without any tendency to snap nor are they adversely affected by the direct and constant contact with water encountered when they are used in wet-drilled shot holes. Worn plastic rods may be made good by welding on extra lengths of Astralon tube, or short lengths of worn rods may be welded together to make new and serviceable units; this makes their use highly economical. The material is both fireproof and non-sparking.
(*Nobel Hefte*, 1957/May/142.)

Silver Decoration on Phenolic Mouldings

Hand-cut silver designs are incorporated in these phenolic mouldings produced by Skånska Ättikfabriken AB of Sweden.

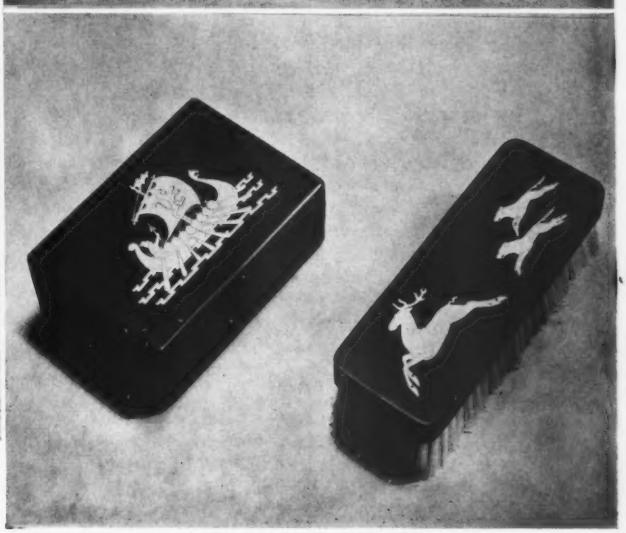
IN the June issue of *Plastics* we reproduced photographs of the melamine tableware manufactured for W. R. Midwinter Ltd. which was awarded a certificate as one of the 12 " Designs of the Year." We now show below examples from the Silver Isolit range of mouldings produced by Skånska Ättikfabriken AB of Perstorp, Sweden, which were shown on this company's and the International Design stand at the recent British Plastics Exhibition, where their obvious qualities attracted much favourable comment.

Their simple shape which enhances the hand-cut silver motifs, and the matt black finish provide a fine example of restrained but imaginative design which combined with the craftsmanship of the silversmith and the skill of the moulder ensure a product of the highest quality.

The use of metal cut-outs in conjunction with phenolic mouldings is not new and was reported in 1937 (see *Plastics*, 1939/Nov./202). At a later date it has been used for the embedding of names or insignia in motor car parts and other products. The appearance of these Swedish mouldings may resuscitate interest in this technique as a method for producing original designs in conventional mouldings for personal use. This is already offered as a service by Skånska Ättikfabriken AB who suggest that coats of arms, mottoes, and monograms would provide suitable subjects for incorporation. This company also manufacture the well-known Perstorp decorative laminates and are represented in this country by Perstorp Products (Gt. Britain) Ltd., 110 Cannon Street, London, E.C.4.

(Above) Ashtray and glass tumbler stands with bull, elk, St. George and sea-god motifs.

(Below) Serving tray, ashtray, tumbler stands, cigarette box and brush with galleon, bull, giraffe, viking craft, and stag hunt motifs.



Formvac Sheet Tester

A new machine and procedure for the testing of material employed in vacuum forming and sheet fabricating

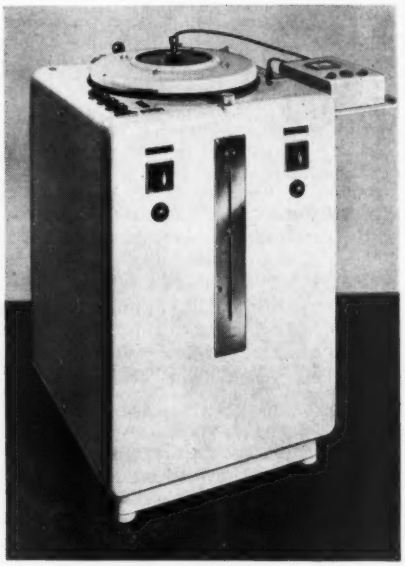


Fig. 1. The sheet testing machine described here.

Introduction

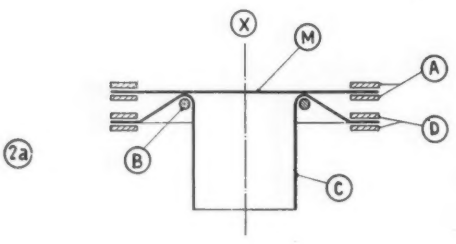
THERMOFORMING, i.e. the art of forming thermoplastic sheet by means of heat and vacuum together with various mechanical assists, is a firmly established plastics fabrication technique. In contrast with injection and compression moulders, etc., the sheet fabricator, however, is compelled to work to a very great extent by rule of thumb as regards the properties of the raw materials he uses. Manufacturers of thermoplastic resins, compounds, film and sheet supply many physical and chemical data which are useful in determining the properties of the final thermoformed product. But the sheet fabricator receives inadequate data for predicting the behaviour of the sheet *during* the forming process.

Most important in the eyes of the sheet fabricator are the elongation properties of the thermoplastic sheet he has to form—how far it will stretch ! Elongation values currently specified are measured by methods borrowed from the metallurgical industry: usually a linear elongation value measured at slow speed on a strip of material at 20° C. Such a value is of limited usefulness in the present case. The sheet fabricator is required to stretch sheet not in one direction but in all directions simultaneously, not at slow speed but very rapidly, and not at 20° C. but throughout a temperature range from about 80° C. to 150° C. for the average thermoplastics. What he requires, therefore, is a graph showing the *variation in maximum areal elongation of thermoplastic sheet throughout the temperature range applicable to thermoforming, measured under physical conditions closely approxmiating those occurring in thermoforming.*

The development of an apparatus to measure these values was initiated in 1954 by Hydro-Chemie Ltd., Zurich, Switzerland, and on the basis of their findings, it was completed in 1957 by Siatem Co., Padua, Italy (who build Formvac equipment under Hydro-Chemie Licence for sale in Italy) with the assistance of the University of Padua. The apparatus, known as the Formvac Sheet Tester, is illustrated in Fig. 1. It is protected by Italian Patent No. 41165 and other foreign patents pending.

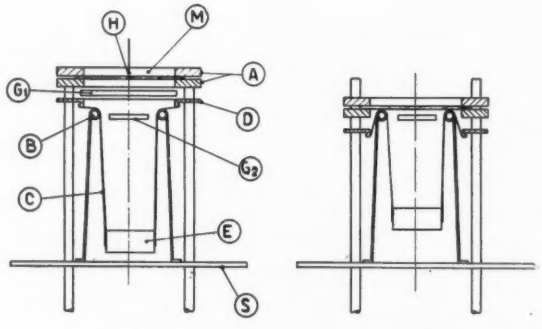
The Stretching Process

The method by which the Sheet Tester subjects heat-softened thermoplastic sheet to rapid, uniform areal elongation is illustrated diagrammatically in Fig. 2. The test specimen M is shown in Fig. 2a clamped between two flanges A and located above an annular frame B over which a " jelly bag " C of non-elastic raw silk is draped and secured at its edge by a flange D. The annular frame is stationary whereas flanges A and D can



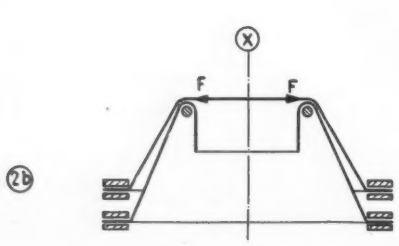
2a

Fig. 2. (Left) Diagrammatic explanation of the stretching process.

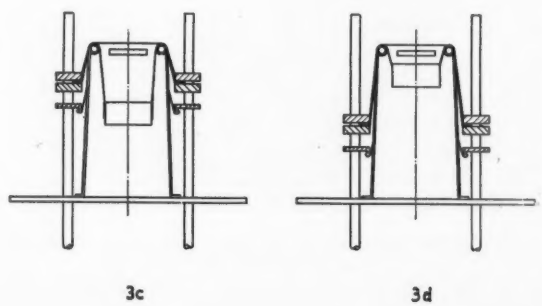


3a 3b

Fig. 3. (Right) Principle of areal elongation measurement.



2b



3c 3d

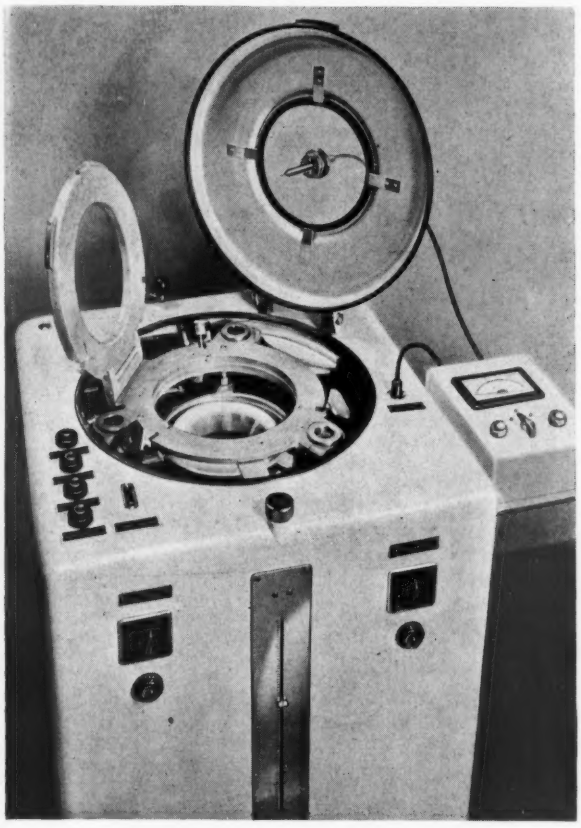


Fig. 4. The sheet tests, showing the cover open and the clamp frame raised for placing the test specimen in position.

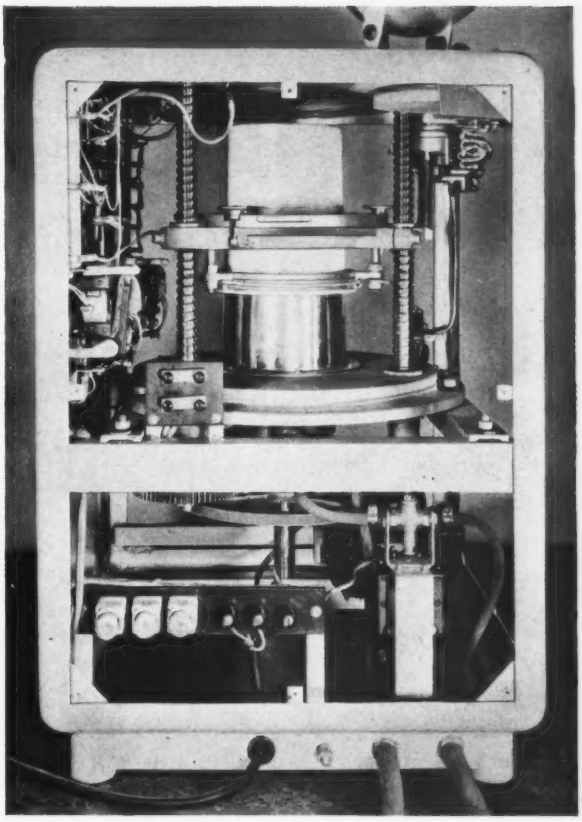


Fig. 5. The drive mechanism on the machine.

travel vertically along the X–X axis. Fig. 2b shows what happens when the sheet is heat-softened and flanges A and D are allowed to travel downwards. The section of sheet enclosed by B has been stretched uniformly outwards by radial forces acting symmetrically across ring B. The forces acting beyond the periphery of B are weaker than those (F) within the ring because the interlocking action of the hot sheet against the mesh of the jelly bag causes the material within the ring to flow without slippage.

The Practical Measurement

How the measurements are executed in practice is shown diagrammatically by Fig. 3. The four diagrams illustrate: (*a*) The material being heated, (*b*) the beginning of the stretching process, (*c*) during the stretching process, and (*c*) the end of the stretching process. The test specimen M is held by flanges A. B is again the annular frame over which the bag C is draped, D the flange to which its edge is secured, and E a counterweight to keep the bag stretched. G is a radiant heating element which can be swung into position so as to subject M to uniform heating. The lower surface of the heater is thermally insulated. Ring B is hollow to permit circulation of cold water controlled by an electromagnetic valve. G_2 is a second heater, designed to prevent M from cooling down after the primary heater G has been swung outwards to allow the stretching operation to proceed. H is a special design of thermocouple of which the tip touches the sheet very lightly and follows it when it sags during the heating process. H is connected with a device which, when the sheet attains the desired test temperature, automatically starts the stretching process. The individual operations are as follows: The test specimen is placed in position on the lower clamp frame (see Fig. 4) and the upper clamp frame is then screwed down firmly. The lid is closed and the thermoelement carefully set in position over the sheet. The desired testing temperature is preset on the releasing device. After the heater has been on for a few minutes, it is swung into position beneath the sheet. As soon as the sheet reaches the preset temperature, the heater swings out and the stretching process begins, i.e. flanges A and D move rapidly towards the base of the machine S. Fig. 5 shows the drive mechanism used for this motion. By means of the round knob visible at the front edge of the top of the machine, the distance which A and D travel i.e. the amount of stretch can be regulated. Reference figures for this are visible on the front panel of the machine, along which a pointer moves when the knob is turned. The amount of stretch must be reduced gradually from maximum until the test can be terminated at a fractional distance before the sheet ruptures. Fig. 6 shows a typical case where, if the travel of A and D towards S had been set at 1 millimetre more, the sheet would have ruptured within the ring. The instant the stretching process is completed, a valve opens to admit cooling water through ring B which is hollow. This immediately freezes the rim of the test section and prevents the sheet from contracting. A and D are then raised, by push-button control, the clamp frame opened and the test piece removed (see Fig. 7). The section of sheet stretched within the ring is then cut out with a pair of scissors and its thickness measured to a thousandth of a millimetre. Division of this thickness into the original thickness of the sheet gives the percentage areal elongation at that temperature. Usually five to 10 trials are necessary before the amount of stretch can be accurately set for a specific temperature so as just not to rupture the sheet. The result should be recorded at least three times and the average value taken. The entire test

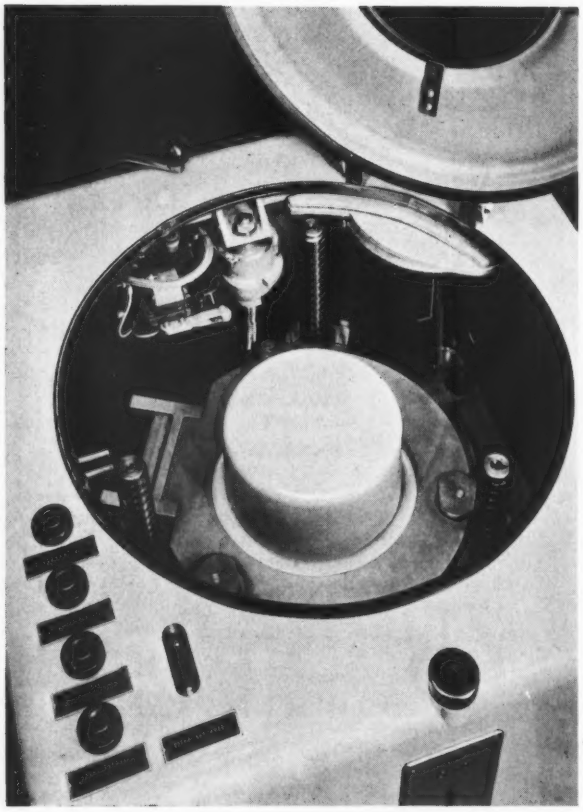


Fig. 6. The test specimen of thermoplastic sheet has been subjected to areal elongation and the stretching process halted immediately prior to rupture point.

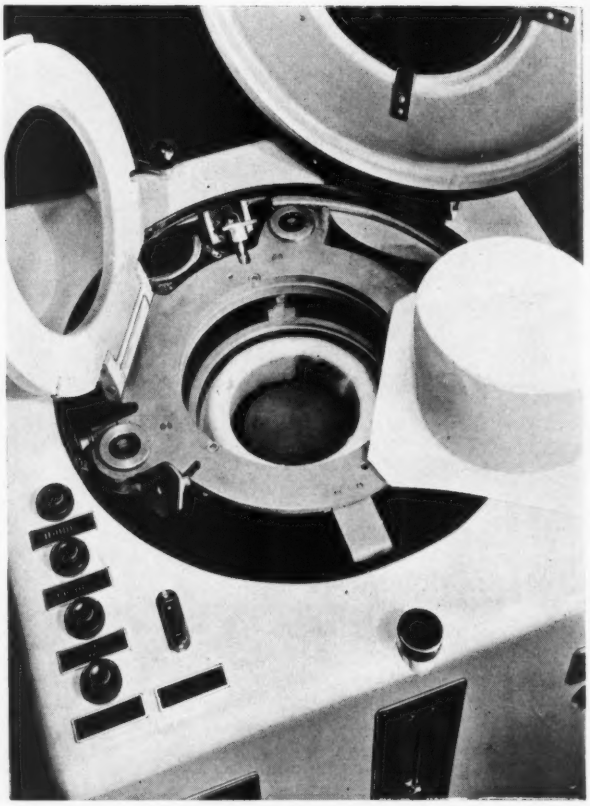


Fig. 7. The stretched test specimen removed from the sheet tester ready for measurement.

should, furthermore, be repeated with two or three different original thicknesses of material, and the average percentage elongation worked out from the two or three test series. Increments of 10° C. are usually adequate for obtaining a satisfactory graph. A graph plotted in this way, using a specific brand of natural-coloured high-impact polystyrene sheet, is shown in Fig. 8. According to the original thickness of the test specimen, the primary heater G may be set at any one of four temperatures, low for the thinnest gauges, high for the thickest specimens. The same applies to the secondary heater G_2. The apparatus may be set for fully automatic operation, or alternatively the individual movements may be executed manually by push-buttons.

Summary

Complete data on areal elongation of thermoplastic sheet constitute a valuable asset for the sheet fabricator. Modern thermoforming techniques enable bodies with extreme depth to diameter ratios to be formed, often with pronounced undercut sections, but with uniform wall thickness distribution. In these cases, therefore, it is possible to work out in advance the percentage of areal elongation required of the sheet, by dividing the original sheet area into the total developed area. By studying the elongation data published by the sheet manufacturer, the sheet fabricator can see in advance whether or not the proposed sheet material is suitable for the product he intends to form. Guesswork is eliminated, disappointments and wastage of sheet are avoided, and the thermoforming project is in accordance with sound technical practice.

Likewise, the possibility of measuring areal elongation is of extreme usefulness to the resin, compound and the sheet manufacturer. It is known that certain additives such as plasticizers, pigments and extenders influence the elongation properties of the sheet. Sheet fabricators have, for example, learned to refuse thermoplastic sheet made from compounds containing extenders, e.g., p.v.c. sheet containing inert fillers such as calcium carbonate, because " it will not stretch." But sheet containing extenders may have sufficient areal elongation for a specific project, and if the precise areal elongation is known to the sheet fabricator, he can take full advantage of the lower price. A practical example is given by refrigerator parts: whereas the food liner mostly requires a material with good areal elongation properties, many inner door liners could most probably be formed from extended sheet, thus appreciably cheaper without any loss in ultimate properties.

The Formvac Sheet Tester is proposed as a new, useful and necessary tool for the thermoforming industry and the sheet fabricating industry in general.

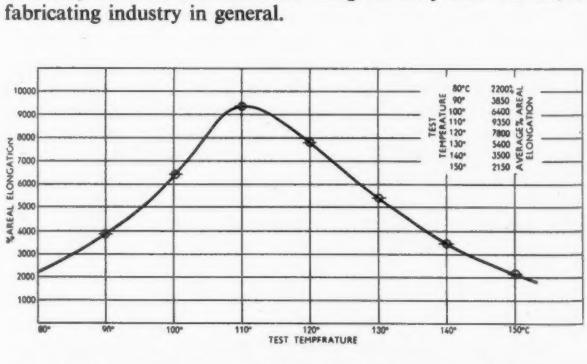


Fig. 8. Specimen graph of areal elongation for an unspecified brand of high impact polystyrene sheet, measured from 80-150°C.

Simulated Wood Graining with Plastics

By T. A. DICKINSON

The use of resins to surface-coat doors and other building units, developed in the U.S.A., is described.

A NEW finishing set-up now being used by Robin Wood Products Co., Pomona, California, U.S.A., permits the rapid application of extremely durable plastic coatings without skilled labour other than maintenance personnel.

The company in this case is a seven-year-old firm which employs 10 to 20 persons on a seasonal basis in a 20,000 sq. ft. plant. It specializes in the production of basket-weave, folding, accordion, and hollow-core doors for residential builders in Southern California.

Contractors find it more practical to buy than to build such doors because they can thus save $1·50 to $3 on each unit—thanks to the high degree of efficiency Robin Wood has attained in making up to 7,500 doors per month.

Most of the doors are made from start to finish with the company's own production facilities. However, hollow-core doors (with laminated plastic facings) are currently being purchased as unfinished products from a subcontractor.

According to Harry and Robert Grossman, the father-and-son team that owns Robin Wood, procurement of the latter type is economically feasible because the aforementioned grain coating set-up makes it possible to sell finished hollow-core doors at prices which are competitively favourable.

Plant Employed

Apart from maintenance, the only human assistance the new finishing unit needs is enough unskilled labour to load and unload its 250ft. chain conveyor. Purpose of the conveyor is to carry hollow-core doors lengthwise through three enclosed chambers, facilities of which include:

(1) A roll coating machine, which is used to apply lacquered grain patterns to the door surfaces.

(2) A water-wash spray booth with fixture-mounted pneumatic spray guns.

(3) Indirect gas heating equipment for drying and curing applied coating materials.

Largest of the chambers is the one in which heating is done. It covers a 22 × 60 ft. floor area.

In order to apply coatings which will withstand all of the rough treatment hollow-core doors may receive in the hands of construction workers, Robin Wood uses a two-stage finishing process. During the initial stage of this process, the roll-coating machine is by-passed so that spray and heating facilities alone are used to apply and dry a more or less conventional primer. In the second stage, doors are grained and finish coated prior to going through the heated chamber.

As a rule, a given quantity of hollow-core doors goes through the first stage in the morning and the second stage in the afternoon of each workday.

The roll coating machine which is used to apply grain was made for Robin Wood by Roto Finishing Systems of Compton, California. It has a pair of etched metal rolls, which are uniformly covered with lacquer by means of doctor rolls; and it transfers fast-drying lacquer patterns from the etched metal surfaces to rubber-covered cylinders, which in turn convey the cellulose patterns to door surfaces.

Finish coatings applied over the doors' grain are clear polyester dispersions with high solid contents, which allow them to produce films of optimal thickness when the doors respectively pass the booth's fixture-mounted spray guns a single time.

Basket-weave, folding, and accordion doors are made by Robin Wood with more or less conventional saws, belt sanders, moulding machines, drill presses, etc., in addition to a number of custom-built tools. Notable among the latter tools are frame-type jigs, used to facilitate the manual assembly of basket-weave components, and an unusual " sewing machine " which rapidly connects the components of accordion-type doors.

Raw materials used in fabricating the door parts are hardwoods such as ash and mahogany. As a rule, no adhesives are specified in assembling the parts—since this might lead to finishing difficulties. However, a cold-setting vinyl glue is used to mate elements in the frames of basket-weave doors.

Clear cellulose coatings are applied to all doors fabricated by Robin Wood in order to preserve the attractive appearance of natural hardwoods therein.

Lacquering operations are currently being accomplished by manual means with three hot-spray rigs, since experience has shown that such equipment can do most to minimize finishing and material losses in view of current production requirements.

The company is now preparing to produce a line of pre-finished 16 × 19 in. tongued-and-grooved wall panelling for the building trades. Since the panelling will be made from hardboard, this will enable the company to make greater use of automatic facilities which are now finishing hollow-core doors.

Roll coating set-up which simulates hardwood grain on laminated facings of hollow-core doors.

LETTERS TO THE EDITOR

Correspondents are reminded that a stamped addressed envelope should be enclosed in all cases where a personal answer is desired. It is understood that any letter received may be published at the discretion of the Editor.

Coated Cloths

[*The communication below was addressed to Dogsboddy and is printed here without his permission.*—ED.]

SIR,—We are very interested in your note "one for the p.v.c. boys" in the August issue—page 290.

We are the U.K. agents for Coverplast of Paris who are the Continental pioneers of p.v.c. coated fabrics for tablecovers, etc. The coating is done by Cordoual of Mulhouse. There are other firms in France in competition, but Coverplast make a wide variety of types on woven patterns, damasks, and on plain cloths with printed patterns on the p.v.c., with the latter designs coated with protective matt lacquers.

The products are first-class, and have a wide sale in France. You may be interested to know that very little "Coverplast" is sold to hotels and cafes. In France the cafes mainly use paper cloths.

In the U.K. we have tried for over a year to interest the principal textile firms in this process, without any success. We have worked with Kohorn Plastics Ltd., a p.v.c. coating plant specializing in thin accurate coatings of fabrics. We could commence production in a substantial way, if any textile firm were really keen.

If the fabrics were coated in bulk by the Coverplast process, and sold with small wholesale margins the resultant products could be retailed at only fractionally more than the old leather cloth, or oilcloth.

If by any chance you obtain any inquiries we shall be pleased to consider them for a revival in this coated process.

Many of our friends and all our staff have Coverplast covers in use in their homes, and they have all been found very satisfactory, and far better and more attractive than p.v.c. sheeting, or the horrible oilcloth products.

You may also be interested to know that in conjunction with a local paper mill, we have developed the strongest paper in Europe as far as we are informed. Owing to the price, we have not found much enthusiasm for a coated base. It may replace leather for reinforcing weak spots in shoes. The fleece is post saturated with a high proportion of resins.

G. F. PARKINSON AND PARTNERS LTD.
1, Brock Street,
Lancaster.

Furniture Inquiry

SIR,—We wish to purchase quantities of the small plastic cups which are used on the base of the tubes forming the feet of tubular chairs, stools, tables, etc., but unfortunately we do not know the suppliers of such items.

We understand that they are a manufactured stock line and supplied in large quantities to the furniture trade in general and we should be very much obliged if your organisation could supply us with the name of a manufacturer of these cups.

K. and B. HUNT.
Sherwood Garage,
63/65 St. Oswald Street,
Collyhurst,
Manchester, 9.

Delegation from India

SIR,—We have sent you under separate cover, a copy of the special *Times of India* supplement published in Bombay to commemorate the Tenth All India Plastics Manufacturers' Conference held on the 19th and 20th April, 1957, under the distinguished Presidentship of Mr. Ramnath Podar and inaugurated by the Hon. Mr. Morarji R. Desai, Minister for Commerce and Industry, Government of India.

We wish to invite your kind attention to the article contributed to the above supplement by Mr. B. D. Garware the President of the Association.

Mr. B. D. Garware who has a direct interest in the Plastics industry has been selected as a member of a delegation sponsored by the Federation of the Indian Chambers of Commerce and Industry and supported by the Government of India. The proposed delegation will be led by the well-known industrialist, Mr. G. D. Birla.

The delegation will visit almost all the important countries in the world. Mr. Garware will naturally be interested in contacting representatives of big plastics houses, plastic machinery and mould manufacturers, plastics raw material manufacturers, etc., with a view to studying the latest developments in the field of plastics, and exploring foreign collaboration in developing the Indian industry.

It will be very much appreciated if you can kindly circulate information about the intended visit of Mr. Garware to your country so that interested persons and firms might keep a note of this and arrange meetings with him to discuss problems of mutual interest.

THE ALL INDIA PLASTICS MANUFACTURERS' ASSOCIATION.
Chowpatty Chambers,
Sandhurst Bridge,
Bombay, 7.

Bonding Plastics to Metals

SIR,—In the contribution "Bonding Plastics to Metals" by J. V. Eurich, which appeared in the June issue of your Journal, pp. 202–204, the author's method is described as constituting a "mechanical bond" as against the "chemical bond" and is achieved, it is stated, "by perforating the metal sheet with small closely adjacent holes and dishing the area immediately surrounding each hole so that, when plastic material is spread over the upper surface of the metal sheet, application of heat and pressure will cause some of the plastic material to be forced through the holes to fill the indented areas underneath so as to anchor the plastic securely to the metal sheet at every hole."

This technique of joining plastics to metals is of interest, but may not necessarily be described as "a revolutionary new approach to the problems associated with the bonding of thermoplastic materials to metal sheets."

In the early days of the war, Dr. N. A. de Bruyne, Managing Director of Aero Research Limited, carried out a number of investigations into bonding metal to plastics by what would appear to be a similar method. The outcome of his work was the introduction of a new material known as "Plastel," which was described in contributions to *Flight*, October 29th, 1942, and *British Plastics*, November, 1942. In the latter journal, it is stated that "in Plastel the metal is stabbed all over with small burred holes and the re-entrant edges of these burred holes engage with the plastic so that the metal and plastic are firmly locked together."

For reasons of space, it is not possible to reproduce the considerable amount of data showing how Plastel improved flexural stiffness and dimensional stability. but readers of your Journal who are interested in the subject may care to refer to these early publications which show that a similar technique to that described by J. V. Eurich had in fact been employed by N. A. de Bruyne some 15 years previously.

K. S. MEAKIN.
Aero Research Ltd.,
Duxford,
Cambs.

"Celastic"

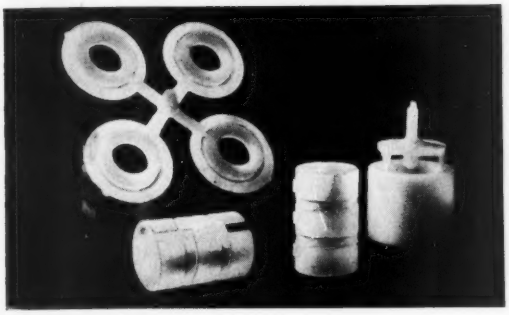
SIR,—With reference to Mr. F. Vernon's letter in the July issue of *Plastics* inquiring about an American product called "Celastic."

The corresponding material is marketed in this country by the B.U. Supplies & Machinery Co., Ltd., Law Street, Leicester, under the name "Samcolastic."

Marine Enterprises Company are Agents for the sale of this material to the ship, yacht and boat building trades in this country and will gladly send full particulars concerning it to any of your readers who may be interested in it for marine use.

J. N. BURGESS.
Marine Enterprises Co.,
30 Cursitor Street,
London, E.C.4.

New Productions



Bearings and washers moulded by Howard Clayton-Wright Ltd., in Grilon A.25 G nylon.

Nylon Bearings and Washers

A selection of bearings and washers moulded in Grilon A.25 G nylon are shown in the accompanying photograph. Of particular interest are the ring runners used in the four impression mould for the thrust washers and the runner and gating technique employed in the moulding of the bearing shown on the right. The moulding is being done by Howard Clayton-Wright Ltd., of Wellesbourne, Warwicks.

Polyester/Glass Fibre Containers

For a weight of only 8½ lb., this Permaglass carrying case manufactured by Permali Limited, 125 Bristol Road, Gloucester, has a very high impact resistance compared with a similar container in metal.

Using the matched metal moulding technique, it is made by Permali Ltd. from chopped strand mat glass cloth and polyester resins and houses portable medical equipment manufactured by the British Oxygen Engineering Company.

Because they are so strong and light and can give a solid colour finish, containers of this type are becoming increasingly popular for protecting a variety of items and apparatus.

Polyester-glass containers manufactured by Permali Ltd.

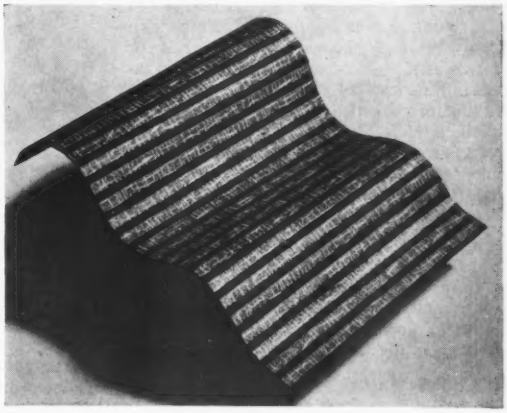
Breathable Coated Fabric

Arlington Plastics Development Ltd. have produced at their Harlow factory a new addition to their Texturide range of vinyl coated fabrics that is completely permeable to air and moisture repellent.

This new development in upholstery materials is known as Gayline Breathable Texturide, and it combines the advantages of both coated and uncoated fabrics in that it is easy to work, gives greater comfort by enabling body moisture to be drawn off, regains its shape after depression without the need for eyelets, and maintains the strength and hardwearing quality of vinyl coated fabrics.

This combination has been achieved by vinyl coating the entire surface of the fabric in two distinct thicknesses giving an attractive striped effect. The heavy vinyl coating that forms the wide ribs is designed to take the heavy wear. The very light coating between the ribs is thick enough to allow the surface to be wiped clean with a damp cloth, and yet is sufficiently thin to allow completely normal air circulation.

It is available in a range of five attractive colours.



An addition to the Texturide range of Arlington Plastics Developments Ltd., a breathable coated fabric designed for upholstery applications. Available in a range of five colours.

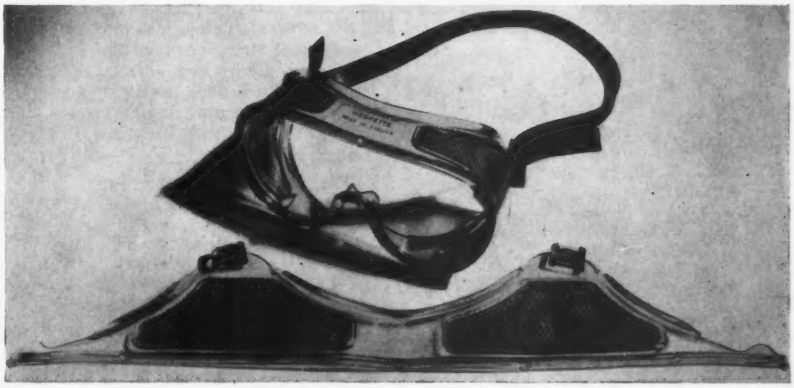
Goggles

A recent production from National Plastics (Sales) Ltd., Avenue Works, Walthamstow Avenue, London, E.4, is the new Vizorette p.v.c. goggles, for Panarama Equipment Ltd. The goggle frames are injection moulded in p.v.c. and incorporate wire mesh side pieces for ventilation purposes. The lenses are made from clear acetate and the head-band is made from Neoprene.

Reinforced Polythene Sheet

The extrusion coating technique is employed by the Plastics Division of The Telegraph Construction and Maintenance Co., Ltd. (Telcon), for the manufacture of several important packaging materials, in which polythene is applied to paper, light boards, aluminium foil and cellulose film. As a result of developments in this technique, Telcon have made it possible for polythene to bring its valuable properties to bear on a different set of problems, involving among other things, containers on a larger scale than usually implied by the term "packaging." The new

(Below) Goggles with p.v.c. frames and acetate lenses.



development is thin polythene sheet reinforced internally with an open mesh of glass fibre, Terylene or other suitable synthetic or natural textile. This material, patented, and bearing the name Telcomesh, possesses the impermeability and chemical resistance of polythene plus greatly increased mechanical strength, and a fair degree of translucency.

The process of manufacture permits considerable latitude in the size of mesh and the ultimate thickness of the product. Most promising so far is a $\frac{1}{8}$ in. mesh coated to a finished thickness of 0.015 in. to 0.020 in. but, using a similar base material, an overall thickness of 0.009 in. is practicable.

One of the original uses for Telcomesh was as a lining for tanks intended to contain corrosive liquids, such as strong acids or concentrated hydrogen peroxide. It also recommends itself as a material for protective clothing for workers handling these substances, especially the last named, against which it is a protection superior to most other plastics. The thinner gauge of Telcomesh is, of course, best suited to this application.

The breaking strain of Telcomesh is 25 lb. per in. for the 0.017 in. gauge, and 48 lb. per in. for the 0.009 in. gauge. The burst strength, at an average of 140 and 125 lb. p.s.i. for the thicker and thinner gauges respectively, is about 50% greater than that of non-reinforced polythene of the same thickness.

P.V.C. Tube Packs

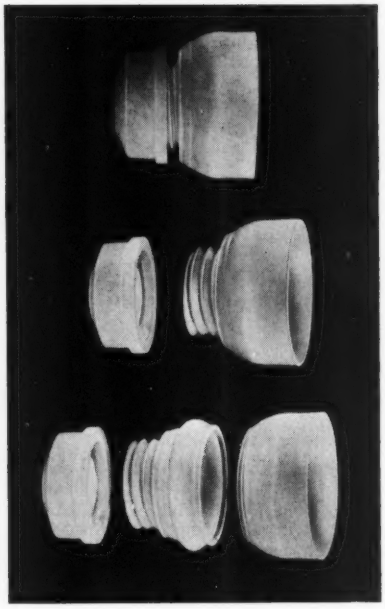
Since John Dale Ltd. took over the manufacture of Dalplas p.v.c. tubes at the end of last year they have done much development work to improve and make practical this type of package.

This pack is unbreakable and is available in a wide variety of colours and with high quality printing they are a plastic pack with a special attraction. Lighter than glass and needing little protection in transit, Dalplas tubes show, in addition, a saving in packing costs.

John Dale freely offer their laboratory test service to determine the most suitable grade of p.v.c. for the product to be packed and, in collaboration with Evans Chemicals Ltd., of Elstree, they can supply a package filled and ready for distribution.

They have also developed a clear lacquer which protects the printing on the outside of the tube so that this will not rub off. Other developments are in process for internal lacquers which should make the Dalplas tube a possible pack for all types of products by reducing loss of weight on storage, one of the main difficulties so far experienced with plastic tubes.

(Above) The Dalplas p.v.c. tube containers.



(Right) Polythene closure for attaching to film.

New Polythene Closure

A new polythene closure has been developed which can be fitted into any polythene liner or bag made from film from .002 in. in thickness up to .010 in.

It is in three parts, comprising an inner neck fitting, an outer neck fitting, and a screw cap.

The inner neck fitting, which has a thread, is placed into a preformed hole in a polythene bag or liner. If there is no preformed hole, one can be cut with a pair of scissors or a knife.

The outer neck fitting is pressed down over the top of the inner fitting, trapping the film between the inner and outer neck. The inner and outer fittings lock into each other trapping the film between a groove and a raised portion. This is done mechanically, added strength being given by heat-sealing, the final closure being leak-proof.

The neck then becomes an integral part of the bag or liner and the screw cap is available for use as required.

The new closure, which is manufactured by Spesco Developments Ltd., of Hanworth Lane, Chertsey, overcomes the problem of joining massive polythene to film.

It is available fitted to a sealed bag to form a complete polythene container for liquids and can also be supplied as a separate unit.

Pre-cut Glazing Panes

Shatterproof glazing panes for factory windows are now supplied precut in all standard sash sizes, according to an announcement by Filon Plastics Corp., El Segundo, California. The company manufactures the only glass fibre panes that are reinforced with nylon for augmented strength and uniformity.

The panes are packaged in cartons of 50 and come in six light-engineered colours which allow preselection of degree of daylight transmitted by the translucent light-diffusing panes. The colours also eliminate the cost of painting factory windows. The panes need no maintenance except occasional washing with water, and are resistant to all kinds of weather.

(Above) High impact polystyrene mouldings by Birkbys Ltd. used on the Neatabell battery bell manufactured by Gent & Co., Ltd.

(Right) Nylon reinforced pre-cut glazing panes made by Filon Plastics Corp.

Plastics News

Plant and Equipment, Materials, Processes, Company News, Technical Literature, Exhibitions, Personal Notes and Meetings.

TRIMMING SAW FOR LAMINATES.—An interesting example of the application of an automatic transfer system is seen in the special Double Trim Saw recently supplied by Wadkin to Bakelite Limited of Birmingham, for trimming large laminated sheets. The machine is essentially two Double Trim Saws based on the Wadkin Double End Tenoner design linked by roller conveyors. In this case the material is fed to the machine direct from the press and the operator's task is merely to lead the sheets along the roller tables on to the chain feed of the first Trim Saw, after which it is fed through the machine automatically.

In this layout the sheets come to the machine from the press and pneumatic rectractable rollers are used to change the direction to bring the sheet on to the feed chain of the first Trim Saw. After passing the pair of saws, which bring the sheet to exact width, the plastic offcuts are fed via chutes and rollers into troughs above the roller table. In an installation designed to handle wood in any form hogging saws would dispose of the off-cut, thus eliminating the chutes and troughs.

After trimming to exact width on the first pair of saws the sheet continues on to power-driven rollers until it makes contact with an electrical trip when the second Trim Saw feed chain takes over and the sheet changes direction through the second set of saws. Having been trimmed to exact length the sheet is finally delivered on to the outfeed roller table.

Before reaching the final pair of saws the leading edge of the sheet contacts a pair of pneumatic end pressures against which the sheet is accurately squared before passing to the saws. The pressures are designed to retract automatically below the sheet after the squaring operation. The pressures automatically reset after the sheet has passed over them.

The machine is manufactured by Wadkin Ltd., Green Lane Works, Leicester.

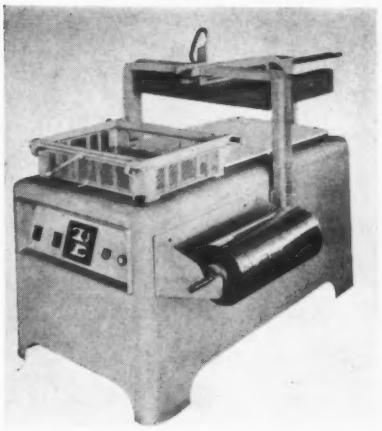
General

Printing on Polyethylene.—New and improved standards of multi-colour gravure printing on polyethylene film have been announced by the Bag Division of E. S. & A. Robinson Ltd., Redcliffe Street, Bristol, 1. Made possible by the use of improved methods and equipment providing accurate registration and colour reproduction, it is understood to compare favourably with the finest quality of colour gravure printing on paper or cellulose film.

New Solvent.—Nitroglycerin Aktiebolaget of Sweden announce the commercial production of a new solvent dimethyl sulphoxide. The sulphoxides have proved extremely effective solvents with high selectivity. Dimethyl sulphoxide is strongly hygroscopic and its unusual solubility properties suggest that it will be suitable for a range of special applications, such as a solvent for cellulose esters, a solvent and selective absorbent for acetylene and sulphur dioxide, as a solvent and re-crystallization agent for organic acids, as a selective separation medium for aromatic and paraffinic hydrocarbons, as a spinning liquid for acrylinitrile, proteins and cellulose acetates, etc.

Technical data sheets, samples and further details can be obtained from the sole selling agents, Guest Industrials Limited, 81 Gracechurch Street, London, E.C.3. (Telephone No. Mansion House 5631).

Synthetic Rubber Import Programme for 1958.—The Board of Trade announce that imports of synthetic rubber into the United Kingdom in 1958 will be authorized up to the level of 80,000 tons of which 60,000 tons will consist of GR-S general purpose rubber and the remainder of various special purpose types. These figures are the same as those in the programme for the current year. The programme for 1958 is subject to review if it is found that requirements are likely to exceed these quantities.

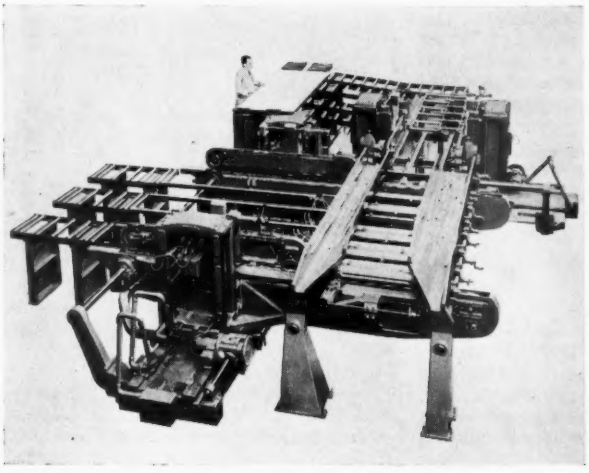


Skin packaging machine manufactured by Plastic Packaging Machinery Inc.

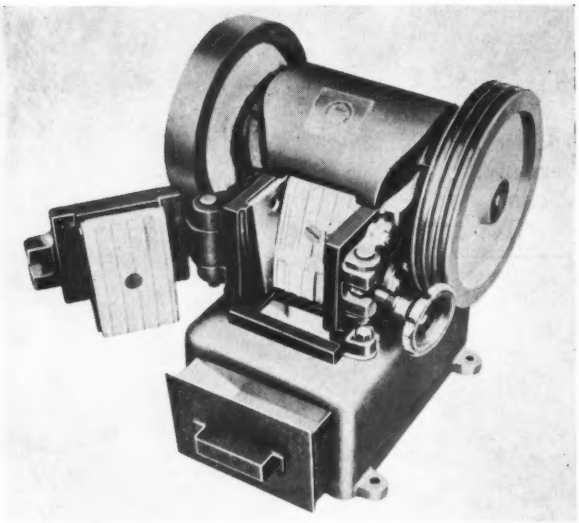
Hungarian Plastics Industry.—Nearly half of the 137-mile Rumanian section of pipeline which will carry methane gas to Hungary for the plastics industry has now been laid down, Mr. Gyula Szeker, Hungarian deputy Minister of Heavy Industry told a Budapest press conference. It was expected that the last delivery of pipes to the Rumanian section would take place by next Spring. Work on the 83-mile Hungarian section would start this year. The pipe will carry 200 million cu. metres of gas annually from just outside Bucharest to Tiszapalkonya, north-east Hungary, where the chemical combine which will turn it into raw material for the plastics industry is semi-completed. The materials are required mainly for making p.v.c. and polyacrylonitrile. Mr. Szeker also announced that construction would be completed this year of the new section of the Hungaria Chemical Works which will produce basic material for the manufacture of Perlon artificial threads. At the Viscosa works at Nyergesujfalu a new section was being built to produce an annual 300 tons of Perlon drawn thread. Production should begin in mid-1958, he said.

Price Reduction.—Whiffen & Sons Ltd. announce substantial reductions in the price of Ralsin (Nylon 11) moulding powder. Ralsin is manufactured in France under the name of Rilsan by Société Organico of Paris. Inquirers are invited to write to Whiffen & Sons Ltd., Fison House, 95 Wigmore Street, London, W.1, for details of the new prices of Ralsin moulding powders, giving, where possible, some indication of the quantities involved.

Nitrogen Blanketing in Polyethylene Processing.—The U.S.I. Technical Service Department has been recommending nitrogen blanketing of polyethylene extruder feed to minimize oxidation. The procedure is said to help solve such problems as gels, fisheyes, dark spots, and similar effects of polyethylene oxidation. The procedure was first tried at Tuscola, Illinois,



The automatic trimming saw for laminated materials manufactured by Wadkin Ltd., for Bakelite Ltd.



New laboratory jaw crushers produced by Knapp & Bates Ltd. of 117 Africa House, Kingsway, London, W.C.2. The crushers are available in two sizes.

headquarters of the technical service laboratory for Petrothene polyethylene resins, sold by U.S. Industrial Chemicals Co., Division of National Distillers and Chemical Corp.

According to Mr. Ralph Knight, Manager of U.S.I.'s Petrothene Technical Service Department, as a further refinement of the procedure the inert gas can also be used to blanket the molten polyethylene as it leaves the extruder, which will reduce build-up of oxidized material on the die lips. The same principle is applicable to other methods of processing polyethylene, such as moulding.

Anti-Static P.V.C. Flooring.—In response to the requests from hospitals for an anti-static flooring for use in operating theatres and other places, the Adamite Company Limited, of Petty France, London, S.W.1, have developed a special anti-static quality of their " Vynoleum " and " Altro " pure p.v.c. flooring.

New Sheet Material.—Suprastyrol sheeting is made from Farbenfabriken Bayer's Novodur, a compound of styrene-butadiene and acrylonitrile and is manufactured by Rheinische Gummi- and Celluloid-Fabrick, and is distributed by R. H. Cole & Co., Ltd., 2 Caxton Street, Westminster, London, S.W.1, in conjunction with Dunstan Hill Chemicals Ltd.

Its advantage over other commercially available thermoplastic sheet material is its impact strength. The heat resistance is also considerably superior to many others. This sheeting can be supplied in a range of opaque colours with matt or polished surfaces, at the moment the main production is in grey, black, white and green, pol/pol, and is tasteless, odourless and non-toxic (except in certain colours). It burns with a smoky flame but is not easily ignited and has a low water absorption figure.

Suprastyrol has good chemical resistance at room temperatures to dilute mineral acids, concentrated hydrochloric acid, dilute organic acids, dilute and concentrated alkalis, salt solutions, lower alcohols, aliphatic hydrocarbons (including petrol) mineral and vegetable oils and fats. It is affected somewhat by prolonged exposure to ultra violet light.

Sheets begin to soften at above 100° C., and vacuum forming is normally carried out at temperatures of 140°–150° C., difficult shapes at 110°–120° C. After forming the sheet is cooled off under tension at about 70° C.

Welding is easily accomplished by usual plastic welding techniques using hot air (270° C. –280° C.) 5 mm from the welding tip. This temperature range is rather important as too high or too low a temperature gives unsatisfactory results. Suprastyrol may also be high frequency welded.

Due to its good solvent resistance Suprastyrol should be cemented with non-solvent adhesives. It has a specific gravity of 1.12.

Literature

Vinyl Compounds.—A booklet issued by British Geon Ltd., Devonshire House, Piccadilly, London, W.1, describes the range of Geon vinyl compounds which have been developed for specific applications. A full list of properties, processing conditions and electrical specifications is given.

Rigid Extrusions.—A technical booklet has been published by British Resin Products Ltd., Devonshire House, Piccadilly, London, W.1, on their Rockite phenolic extrusions.

Polyester Handbook.—Scott Bader and Co., Ltd., of Wollaston, Wellingborough, Northants, have recently published the third edition of their Polyester Handbook. This edition is considerably larger than the former ones and gives more data on processes and design as well as the latest information on the Crystic and Marco resins manufactured by this company.

Laminated Materials.—Bakelite industrial laminates compiling with B.S.I. and S.B.A.C. specifications are listed in a new handbook published by Bakelite Ltd., 12–18 Grosvenor Gardens, London, S.W.1.

Unpublished Reports.—Copies of the following reports can be obtained on application to: Department of Scientific and Industrial Research, Lending Library Unit, 20 Chester Terrace, Regents Park, London, N.W.1.

The Development of Electrical Conduction Transparent Coatings for Acrylic Plastics Sheet. —PB. 121104. Methods are discussed for the preparation of transparent conducting films on both acrylic and glass surfaces. The theory of the structure of such films is presented as well as a description of techniques involved in their preparation.

Post-Moulding Characteristics of Some Thermosetting Plastic Moulding Materials.—PB. 119042. Nine commercially available melamine, phenolic and polyester resins were investigated for dimensional stability by an accelerated ageing test (cycles of two days at 125° or 100° C./one day at 23° C.). Best results were obtained with mineral-filled polyester resins.

Cold Dip Strippable Compounds. —PB. 118321. Gel lacquers of cellulose acetate butyrate, with various plasticizers, resins and corrosion inhibitors, formed a fairly mobile, clear solution at 120° F., and set to a clear, firm and readily strippable gel of adequate thickness at 75°–100 ° F.

The Synthesis of Methyl-Substituted Fluoranthenes.—PB. 118679. A new range of liquid perfluorocarbons with low dielectric constant and low loss tangent properties, very wide liquid range, inertness, etc., has been prepared (to be described in a later report) by fluorination of (I) *dl-cis*-1,4-dimethylfluoranthene. The dialkylation of fluoranthene via sodium and methyl iodide or dimethyl sulphate was carried out in these experiments for the first time.

Four Articles on Butadiene Polymerization.—PB. 119142. The four articles are entitled: (1) Styrene popcorn polymer and the effect of various sulphur-containing compounds on its growth; (2) the effect of various free-radical initiators on butadiene polymerization; (3) attempts to produce popcorn copolymers; (4) miscellaneous investigations, e.g. growth of mixed butadiene/styrene popcorn seeds, formation of dimer, etc.

Shelf Life of Neoprene-coated Nylon Fabrics. —PB.111728. The results are given of a study to determine the shelf life of these fabrics. Nineteen coated fabrics, which had been stored for periods varying from one to over four years, were tested; the samples included four types of neoprene, and one of Buna-N, applied to several constructions of nylon.

Research and Development of High Strength Reinforced Plastics for Ordnance Use.—PB. 111721. The report describes the development of parallel glass fibre structure for the reinforcement of plastics with good handling characteristics through the use of cured thermosetting resin binder systems. The effect of glass fibres which were treated with a wide variety of chemicals in the form of a mist surrounding the hot fibres immediately they issue from the bushing, was studied.

Electron Microscope and Electron Diffraction Study of Optically Transparent Electrically Conducting Coatings on Glass and Acrylic Plastic.—PB. 118266. The work described in this report was carried out as part of a programme to evaluate various conducting coatings intended for use on (1) aircraft windshields in preventing fog, frost, or ice, and (2) on transparent aircraft canopies for the purpose of dissipating precipitation static charges. It was found that the conducting coatings consisted of very fine miscroscopic crystals closely bound to each other and to the glass substrate in the form of a continuous film.

Development of Electrically Conductive Transparent Coatings for Acrylic Plastic.—PB.121208. The report describes the adaption of the Marklad process, to the application of transparent static-dissipating coatings to acrylic

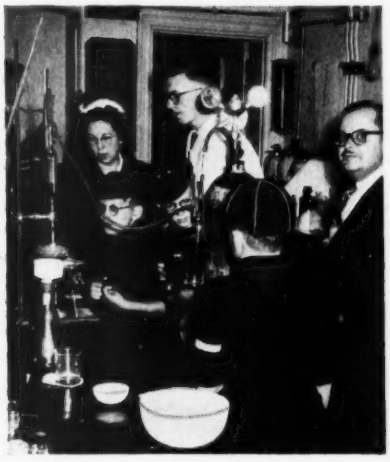
plastic, including curved surfaces such as occur in aircraft canopies. It was established that coated meter windows, having resistivities readily attained by the Marklad process will adequately protect sensitive meter movements against external static charges or the accumulation of charges on the windows themselves. Flat sheets were coated so as to have resistance in the range of 1 to 10 megohms per square (see Fed. Spec. L-P-406b, Method 4041), light transmission of 75 to 85% and haze of 1.0 to 2.5%. Uniformity was improved so that 90% of the area of a flat sheet was encompassed within one order of magnitude.

Effects of Moulding Pressure on the Strength Properties of Several Types of Glass Fibre Reinforced Plastics.—PB.121196. The report describes work carried out on the mechanical properties of laminates fabricated from a polyester resin reinforced with woven glass fabric or with 2 oz. or 8 oz. unoriented glass fibre mat. The laminates were fabricated in an open mould at moulding pressures of 1, 10 and 100 lb./sq. in., and in a closed mould at 10, 100 and 500 lb./sq. in. The resin content of the free edge panels varied with the moulding pressure, while that of the closed-edge panels was maintained at a constant value for each type of reinforcement. Specific gravity, resin contents and voids content were also determined. Results indicate that the properties of laminates fabricated in the closed mould do not vary appreciably with changes in moulding pressure. However, the flexural and tensile properties of panels moulded in the open mould increase as the pressure increases from 1 to 10 lb./sq. in., but do not change appreciably at higher moulding pressures. Compressive strength shows a tendency to decrease with increasing mould pressure.

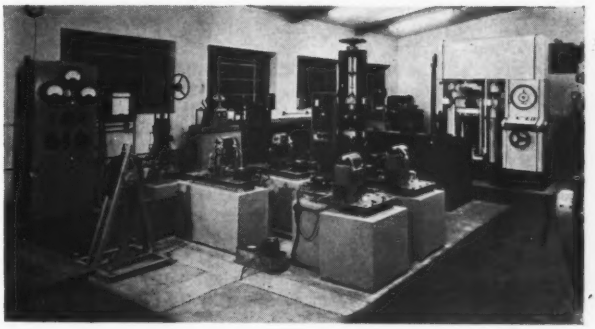
Alkyd Resins.—The Board of Trade give notice that they are considering an application for a change in the method of charging import duty on solutions of alkyd resins (whether modified or not) in hydrocarbon oil.

Glands for Thermoplastic Cables.—The Telegraph Construction & Maintenance Co. Ltd., have issued a pamphlet showing the range of Telcon termination glands for use on thermoplastic cables.

Plastic Orthopædic Appliances.—A catalogue of these appliances has been prepared by the manufacturer, U. Williams & Co. Ltd., 70 Sanderstead Road, South Croydon, Surrey.



Open day at Dr. V. E. Yarsley (Research Laboratories) Ltd.



The Mechanical Testing and Fatigue Laboratory at the Fulmer Research Institute.

Packaging Brochures.—Four new Brochures have been issued by British Celanese Ltd. on the use of acetate sheet and film for packaging.

Company News

New London Office.—The London office of **Thermotank Ltd.** has moved to larger premises at Marine Engineers' Memorial Building, 18 London Street, London, E.C.3. The new telephone number is Royal 7343–4.

The telephone number of the offices and works of the Thermotank Group at West Drayton, Middlesex, is changed to West Drayton 3685–9.

BX Plastics Ltd. announce the purchase by them of Extrudex Ltd., Bracknell, Berks., the well-known manufacturers of chemical plant and tubing in rigid vinyl material, who will continue to operate as a separate organization.

The British Plastics Federation have changed their telephone number to Regent 2041/4.

New Resin.—The Durez Plastics Division of the Hooker Electro-Chemical Company announce that they have brought out an additional Hetron Resin—"Hetron 33"—which is a semi-rigid, self-extinguishing heat-resistant product that will appeal to producers of flame-resistant resins for many different applications. It is highly recommended for use where high impact and structural strengths are required. Further technical data and samples can be had on request from the sole representatives of Durez in the United Kingdom, Omni (London) Ltd., 35 Dover Street, London, W.1.

Esso Petroleum Company Limited announce that they have entered into an arrangement with Union Carbide Limited whereby they will supply ethylene gas to the new £3,000,000 petrochemical plant which Union Carbide Limited propose to construct on a 52-acre leased site adjacent to the Esso Refinery at Fawley.

As already announced, Monsanto Chemicals Ltd. and The International Synthetic Rubber Company Ltd. will be drawing raw materials from this same source.

British Tyre & Rubber Co., Ltd., announce that, as from September 16th, 1957, subject to confirmation by stockholders, its name will change to BTR Industries Ltd.—a title designed to emphasise its relationship to industry in general as British Thermoplastic and Rubber Manufacturers.

The "BTR" trademark will continue to identify the great variety of products marketed by the company.

William Rose Ltd. have moved to Hilyn Works, Lockfield Avenue, Brimsdown, Enfield, Middx. Tel.: Howard 4136/7.

Horwitch Smith & Co., Ltd., have re-equipped their premises at 42, Lower Loveday Street, Birmingham, 19, and concentrated the whole of the manufacturing capacity of p.v.c. paste of all types, the grinding and colouring of polythene, nylon, Perspex and epoxide resins at these works.

These works are now equipped to give demonstrations of the Knapsack-Griesheim Whirl Sinter Equipment, the flame spraying of all types of polymers, the spraying of p.v.c. spraysols and the dip application of p.v.c. plastisols and plexiges.

Dane & Co., Ltd., 1–2 Sugar House Lane, Stratford, E.15, are now manufacturing a series of Vinyl Inks under licence. These are the products of Johann Karl Kochen of Krefeld, Germany, sold under the trade name Herkula.

They include Intaglio inks, tipping finishes for p.v.c., etc., p.v.c. inks for leatherette, embossing inks for fabric, wipe shading inks.

Union Carbide and Edison Polyethylene Production in Italy.—The formation of a new Italian company named Celene, S.P.A., has been announced by Union Carbide Corporation. The new organization, which is jointly owned by Union Carbide Corporation and Societa Edison of Milan, will manufacture and market high-pressure polyethylene in Italy. Plans call for supplying initially 24 million pounds of polyethylene annually to the Italian plastics industry. Ownership of the new company is shared equally by the two principals.

The Pulsometer Engineering Co., Ltd., of Reading, have acquired the whole of the issued share capital of the Self-Priming Pump and Engineering Co., Ltd., of Trading Estate, Slough, manufacturers of aircraft fuel pumps and hydraulic equipment.

New Company Formed.—As a result of their extensive experience in the field of hydraulics and pneumatics for the aircraft industry, The Turner Manufacturing Co., Ltd., of Villiers Street, Wolverhampton, have formed a subsidiary company, **Hydraulics and Pneumatics Ltd.**, for the manufacture of hydraulics and pneumatics for general industrial requirements.

C.S.R. Chemicals Pty. Ltd. announce plans for building a new plant to launch the Australian production of vinyl acetate monomer. This announcement follows a recently-concluded agreement with **British Celanese Ltd.**, whereby the latter will provide

know-how and technical assistance in the erection and operation of the plant.

Work on construction is commencing immediately, and the plant is expected to be in operation before the end of 1958. Its production capacity should meet the anticipated Australian demand for some years to come. The project will cost about £A500,000.

Polyvinyl acetate and other derivatives of vinyl acetate have become important in many fields of manufacture, including modern emulsion paints and new types of adhesives.

For some time past, polyvinyl acetate has been made in Australia from imported vinyl acetate. The new C.S.R. Chemicals plant by producing the monomer there, will fill a gap in the manufacturing chain from local raw materials to end-uses.

The raw materials for vinyl acetate production there will be based primarily on the sugar industry. One of the major processes in the Company's existing plant is the conversion of industrial alcohol—made from sugar cane molasses—to acetaldehyde and acetic anhydride. These two chemicals have for some years been produced at the Company's Rhodes plant for other purposes. Now they will provide the two raw materials for vinyl acetate production.

Personal

Examinees.—From the Plastics Institute comes the 1957 list of candidates who have completed their educational requirements of the Associateship of the Institute. The following initials denote the centre at which the examination was taken: N.C.R.T., National College of Rubber Technology; C.T.B., College of Technology, Birmingham; A.T.C., Acton Technical College; B.P., Borough Polytechnic.

S. N. Angove (N.C.R.T.); M. W. Aston (C.T.B.); D. F. Bailey (C.T.B.); J. H. Briston (A.T.C.); G. C. Butler (B.P.); W. P. J. Cartmell (N.C.R.T.); R. H. Chambers (N.C.R.T.); A. M. Cottrell (A.T.C.); M. H. Elson (N.C.R.T.); A. D. Mann (N.C.R.T.); H. May (C.T.B.); R. W. G. Sadler (A.T.C.); J. A. F. Serbenski (A.T.C.); J. D. C. Shanks (B.P.).

The following students qualified for Graduateship: S. H. Brindley (C.T.B.); P. I. M. Caldwell (C.T.B.); W. R. Dean (N.C.R.T.); F. E. Porner (A.T.C.); W. G. K. Taylor (C.T.B.); Z. W. Troczynski (C.T.B.); H. L. Tulloch (C.T.B.).

Mr. E. H. Beaumont who has been appointed a director of the Industrial Adhesives Division of Evode Ltd.

Members of the Swedish Plastics Federation photographed during a visit to the Brantham Works of BX Plastics Ltd. Seen with them is Mr. J. D. Parsons, Assistant Export Sales Manager, BX Plastics (top right) and other members of BX staff.

New British Geon Appointments.—Two new appointments are announced by British Geon Ltd. to take effect as from August 19, 1957. **Mr. S. A. Williams** is appointed export manager, whilst **Mr. G. M. McCarthy** is being transferred from British Resin Products Ltd. to become British Geon distribution manager, a post which has been held by Mr. Williams since 1955.

The Telegraph Construction and Maintenance Co., Ltd., announce the appointment of **Mr. J. L. Woollett** as manager of their London branch at Mercury House, Theobald's Road, W.C.1, in succession to Mr. A. W. Matkin, who has left the Company.

Mr. F. T. Walker has been appointed manager of Telcon's Nottingham branch in succession to Mr. Woollett.

Mr. Francis Hock and Mr. Hans Hock have joined the Board of O. & M. Kleemann Ltd.

New Chairman.—The President of the Board of Trade has appointed **Mr. W. R. Black** to be Chairman of the National Research Development Corporation in succession to the late Chairman, Sir Alan Saunders, who died in February.

Mr. J. M. Gafford has been appointed head of the Manufacturing Department of W. R. Grace & Co.'s high density polyethylene plant to be operated shortly by the Polymer Chemicals Division at Baton Rouge, La.

Mr. Gafford will be responsible for production activities related to the manufacture of polyolefin resins.

Dr. R. Owens.—The Ministry of Supply announces that Dr. R. Owens has been appointed Director of Explosives and Chemical Production.

Mr. Robert P. Marshall has been appointed assistant sales manager of the Chemical Division of Coalite and Chemical Products Ltd.

Monsanto Chemicals Limited announce the following appointments to its Chemicals & Plastics Divisions.

Mr. D. R. Mackie has been appointed Director of the Chemicals Division in addition to his duties as Managing Director.

Dr. J. W. Barrett has been appointed Director of the Plastics Division in addition to his duties as Technical Director.

Mr. N. F. Patterson, previously Operations Director, now becomes Director of Production and Engineering with additional overall responsibility for Purchasing Department, and, through Mr. S. E. Chaloner, Labour Relations.

Dr. W. H. Garrett becomes Personnel Director responsible for Industrial Relations and general personnel policy.

Mr. W. Morgan Thompson, Sales Director, has resigned from the company on taking up another appointment.

Mr. D. C. M. Salt has been appointed General Manager of Sales of the Chemicals Division and **Mr. J. S. Hunter** has been appointed General Manager of Sales of the Plastics Division.

On the retirement of **Mr. F. S. Mortimer,** Manager of the Industrial and Public Relations Department, **Mr. A. R. Crew,** Manager of the Advertising Department, has now taken over responsibility for Public Relations also.

The wholly-owned subsidiary, Monsanto Plastics Limited, will cease to function in view of the change to divisional organisation. Sales of styrene plastics are now the responsibility of the Plastics Division. **Mr. G. V. Cox** has been appointed Manager, Plastics Sales Department, and will be responsible to Mr. Hunter. **Mr. E. L. Pixton** has left the company.

PLASTICS

The price of *Plastics* is to be increased to 3s. starting with the next issue, dated October. The price has remained unaltered at 2s. 6d. since June, 1951 but production costs have risen so steeply during the past six years that an increase in the selling price of the journal has now become unavoidable. We are confident that this step will be accepted by our readers as preferable to any lowering of the present standards of production.

The new subscription rates for *Plastics* will be 44s. per annum, post free, and $6.50 for subscribers in Canada and the United States. Current subscriptions will be continued at the old rate until they become due for renewal.

Automation Equipment

Batch Counter. — This industrial batch counter now being produced by the Instrument Division of Ericsson Telephones Ltd., has a maximum counting speed of 350 pulses per second and has been designed for counting into batches of any given number, objects of varying size and shape. The count is displayed on dekatron tubes and the required count per batch is set up on rotary switches and can be any number up to the total count of 10,000. The instrument can also be used for the measurement of lengths.

The necessary input pulses can be obtained from mechanical, photo-electric or electro-magnetic devices and output facilities suitable for the control of chute flaps and other equipment are available.

When the selected count per batch has been completed, the instrument automatically resets and the counting of a further batch commences. Seven paralysis times for overcoming the spurious pulses which sometimes arise in counting irregularly shaped objects are selected by means of a rotary switch.

A manual reset switch is also provided.

All the necessary photo-electric heads, lamp housings and chute mechanisms suitable for certain applications can be supplied with the instrument.

Ericsson Telephones Ltd., Instrument Division, High Church Street, New Basford, Nottingham.

Magnetic Separator. — Rapid Magnetic Machines Ltd. announce a new high intensity induced roll separator which provides the necessary magnetic field for purification of free flowing granular materials.

Magnetic Separator by Rapid Magnetic Machines Ltd.

A considerable reduction in overall size, and wattage below hitherto applicable machines has been achieved.

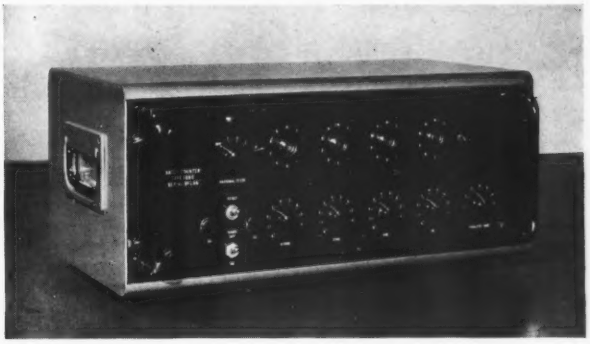
The basic unit has a 5 in. Diameter Roll, with two parallel 5 in. feed widths. Several such units may be fitted together to provide a separator with any number of rolls for difficult separations, or where selective separation of different materials is required.

Dependent upon the material size and magnetic susceptibility, a typical figure of 1½ tons per hour for the purification of silica sand quoted.

In addition to its rugged construction, sealed bearings are used throughout, which ensure long trouble-free life. Also for ease of maintenance, every part of the separator is either removable, or readily accessible.

Each magnet coil is rheostatically controlled, thus allowing variation of energy at each roll.

Rapid Magnetic Machines Ltd., Lombard Street, Birmingham, 12.



Industrial batch counter produced by the Instrument Division of Ericsson Telephones Ltd., having a maximum counting speed of 350 impulses per second.

Temperature Control Unit and Process Timer.—The temperature control unit type N241 is a sensitive robust instrument suitable for incorporation in industrial installations. It operates over the temperature range—70° C. to +600° C., control being effected by a heavy duty output relay fitted with three sets of contacts:—8 amp. single pole changeover, 1 amp. single pole changeover and 1 amp. single pole make-before-break.

The sensitive element is a small platinum resistance, robust and completely stable. It is available in two forms, either ⅛ in. diameter by 2 in. long or ¼ in. diameter by 6 or 24 in. long.

Operation of the output relay is effected by a 0.1% change in the value of the temperature sensitive resistor which represents a temperature change of about 0.4° C.

The process timer type N237 provides an accurately timed switching facility for industrial control purposes over the range 1 to 10 and 10 to 100 seconds.

The starting signal may consist of a connection or disconnection of a pair of contacts and may be either a short pulse or a contact longer than the timing period. The versatility of the timer also allows it to be connected in a number of different ways, e.g. (*a*) two timers back to back, (*b*) two or more in tandem, and (*c*) three or more in a ring circuit.

The unit is housed in a small robust case and may be supplied with the time control adjustable by means of a knob on the front panel or a sealed screwdriver slot to prevent tampering.

Airmec Ltd., High Wycombe, Bucks.

Capacitance Monitor and Controller System K.—Series K capacitance gauging systems have been designed to monitor continuously, and maintain constant automatically the capacitance of insulated conductors. Their main application is to the control of wall thickness of cellular or foamed plastics, and that of telephone and high frequency cables whose specifications call for constant capacitance rather than constant diameter. Another application is the automatic control of average wall thickness in the extrusion of jackets over metal sheaths, especially where these sheaths are not circular in section or of varying diameter.

Series K capacitance gauging systems form part of the unitized range of Addison Size and Eccentricity Control Equipments. They may be used as Monitors only, or in conjunction with the standard automatic control unit. In either event the standard strip chart recorder unit can be added.

With the gauge head immersed in the cooling trough, System K will sense and correct extrusion errors at the earliest possible moment. No direct contact is made with the cable.

By means of two guage heads it covers the range 0–3½ in. (90 mm.) overall diameter, with a precision of ½% of the total capacitance, independent of extrusion speed.

Direct visual tolerance pre-setting, and the unique feature of cable speed controlled correction rate, which renders the controller entirely independent of extrusion speed, greatly facilitate the operator's task.

The complete equipment consists of three items:—

1. The Gauge Head, available in two interchangeable models.

These heads are constructed of stainless steel, and comprise ground, guard and electrode circuits.

2. The Instrument Cabinet incorporates at the top the Indicator Unit with the controls for pre-setting the required capacitance, and a linearly scaled indicating meter with the two tolerance controls.

3. The Servo Motor supplied with the System may be arranged to control the capstan speed variator, or the extruder screw speed variator.

The Addison Electric Co., Ltd., 10/12 *Bosworth Road, London W.*10.

TALKING SHOP . . .

Pigsiana. The more one observes the Pigs on their peregrinations around the lusher golf-courses of Surrey and Berkshire the more *porcophile*, as it were, one becomes. Tom Crabtree's account of his stewardship of a most distinguished office never fails to pall; the amiable grin of Hubert Clement is a benison. And Cyril Last, when he is free from affairs of state, is the master chairman. Below are two more photos of a recent happy event, the competitions at Sunningdale in July (see August issue, page 290) for the Waghorne Trophy and the *Plastics* Goblets. Charles Waghorne was unfortunately not able to be there to present his trophy, and Jack Selby deputised. The trophy was won by L. W. McCabe, the runner-up being Percy Smith. Mr. Roland E. Dangerfield presented the *Plastics* Goblets to the winners, Frank Oldham and Tom Crabtree, and below Bert Birrell is seen presenting the prizes to the runners-up, Gilbert Brooke-Hitching and Jim Lassen.

* * *

Institute Annual Luncheon. Held this year at Olympia, during the British Plastics Exhibition, the luncheon was distinguished with the presence of Peter Masefield, Managing Director of the Bristol Aeroplane Company, Ltd., who was the principal guest. He made what was certainly the funniest and probably one of the most acute speeches yet heard at an Institute function. One of the topics he discussed was automation, a development he has obviously studied deeply. Emphasizing its importance he unconsciously perhaps touched upon a *iacuna* in the plastics industry's thinking on technology, for it was not until this journal published a supplement on automation (September 1956, pages 217–248) that views on the subject were fully crystallized. Even now, whilst equipment designed to introduce automation continues to be improved or originated, the full implications of the concept, *per se*, have been little discussed. Perhaps this is because our industry has always been in the van of mass production, and thus near the apex of the high output/low employee ratio. Because the basic tenets of such processes as injection moulding have always included research for faster cycles and, ultimately, automatic operation, we have tended to absorb automation without thinking about it except purely in terms of higher output at lower cost. That it means much more than this, in terms of training skilled personnel to build and maintain the equipment of the future, was one of the points made by Mr. Masefield.

M. J. Selby congratulates Mr. L. W. McCabe, winner of the Waghorne Trophy.

During the luncheon Mr. J. Lionel Daniels handed over the chain of office to the incoming President of the Institute, Dr. J. C. Swallow who, too, caught the unusual tenor of the meeting when he expressed his gratification at assuming the Presidency at such an exciting point in the history of the industry. Few who were at the exhibition and luncheon would disagree that perhaps for the first time the industry was grasping the magnitude of the developments since, for example, the end of the war. Sir David Eccles, when he opened the exhibition on July 10, uttered no platitude when he said that plastics had now become one of the great industries.

* * *

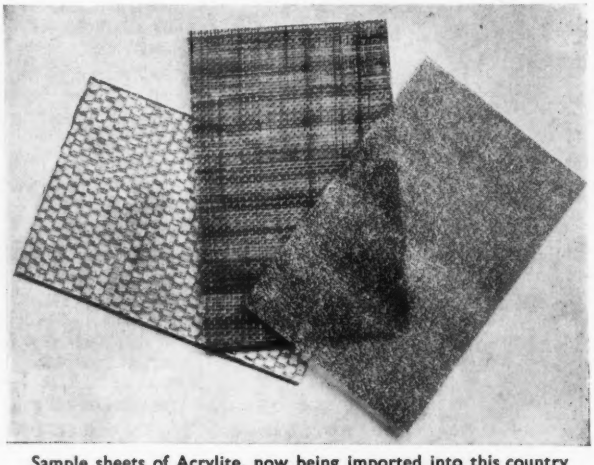
B.I.P. In the August issue of *Plastics*, page 290, we published a photograph of a very memorable occasion, a dinner at the Café Royal, London, in honour of Charles Glassey, managing director of the British Industrial Plastics Ltd. Honoured with him that evening was Cyril Dingley, who also has served fifty years with the company. Both were born and bred in Birmingham, both strived during the critical periods of the company's history to bring the group to a foremost position in the industry. This, they and their colleagues have done, and many of their friends from all over the world were with them at the domestic celebration of their achievements, at the Café Royal.

Mr. C. H. Glassey and Mr. C. S. Dingley at the Café Royal Dinner.

* * *

Decorative Sheet. What could be a big competitor to existing decorative sheet materials has just come to my notice. Imported from North America by Redmond Fletcher Ltd., 35, Bedford Road, London, W.C.1, it has the trade name Acrylite. Presumably an acrylic

Mr. T. L. Birrell presents the "Plastics" Goblets runners-up prizes to Mr. E. J. Lassen and Mr. T. G. Brooke-Hitching.



Sample sheets of Acrylite, now being imported into this country from North America, where it is used as decorative panelling, etc.

derivative, the transparent sheet has embedded within it woven cane, aluminium foil, fabrics etc., as well as facsimile leaves and butterflies. My photo below shows three typical samples. Possible applications include screens, partitions, shelf-backs, lighting panels, furniture construction and decoration, and smaller items such as decorative boxes, trays, bowls etc.

* * *

Borough Students Tour Germany. Nine students of plastics technology from the Borough Polytechnic were very kindly entertained by Farbenfabriken Bayer A.G. and Farbwerke Hoechst A.G. during a holiday tour in West Germany between July 7 and 16. Each visit occupied a full day and whilst plastics development and production was the subject of main interest, in each case the party was also shown some of the wider aspects of chemical manufacture. At Leverkusen and at Frankfurt-am-Main the visits were of similar pattern. The morning was spent touring the vast areas of the factories in a coach provided by the management, stops being made to inspect processes, installations or laboratories of particular interest. An excellent luncheon was then given and in the afternoon a film covering the enormous range of the activities of each concern was shown in the private cinema. The party was indebted to Dr. Kohler and Dr. Low, of Bayer, and to Dr. von Klenck and Dr. Spoun, of Hoechst, for their personal efforts in making the visits an event to be remembered both as regards technical interest and delightful hospitality.

* * *

Plastics in the Home. The photo above shows the stand of Plastocraft Products (Darwen) Ltd., at this year's B.I.F., sent to me by Mr. S. Bradley, sales director of the company. It is only ten years since Plastocraft adopted plastics as a medium for the manufacture of door handles and furniture. During that period a substantial business has been built up, currently turning over £500,000 year, and employing 150 people. The U.S.A., New Zealand, South Africa, and Rhodesia are amongst the countries to which handles of many types and of many plastics materials are exported.

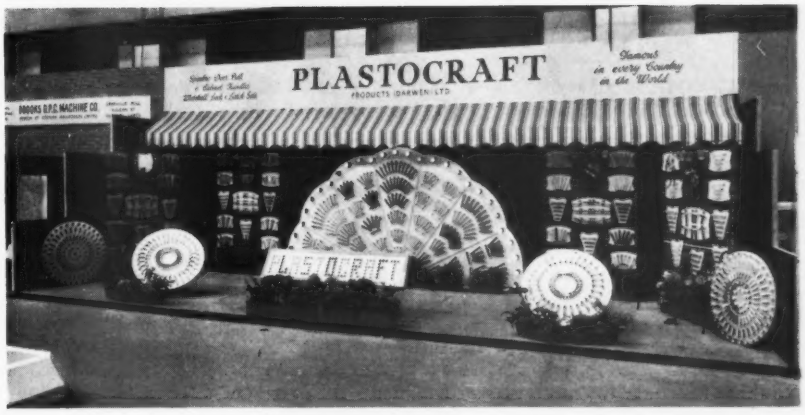
* * *

Plastics and Boats. On page 385 of this issue is a short account of a new technique for boat constructors. Fuller details of the process are embodied in a leaflet obtainable from Turner Brothers Asbestos Company, Ltd., at Rochdale, and I show above a photo of a typical hull which has been sheeted with Duraglas. This is a development that would seem to have a bright future.

* * *

New Petrochemicals Plant at Fawley. Union Carbide Corporation has announced that a new unit is to be constructed at Fawley for the manufacture of ethylene oxide derivatives. The plant is scheduled to go on stream in 1959, and the site area is 58 acres. This is the second major petrochemicals facility in the U.K. under construction by the Union Carbide organization. The first, at Grangemouth, is due to go on stream next month.

PLASTIKON.



(Above) The B.I.F. stand of Plastocraft Products (Darwen) Ltd.

(Right) A boat hull sheathed with Duraglas manufactured by Turner Brothers Asbestos Company, Ltd. The technique combines the traditional skill of the boat-builder with the advantages of the new materials.

Borough Polytechnic German tour:—Seen here at Hoechst, from left to right, are Mr. S. C. Hart-Still, N. R. Dass, Dr. von Klenck, G. T. Whiting, C. Ayton, D. Moxey, Dr. Spoun, C. R. Fletcher, A. Lobo, J. Dando, G. Williams, and R. Youdell.

Polyester-glass fibre globe of the world at the recent Scout Jamboree at Sutton Coldfield.

New American Perfluorocarbon Resin

APPROXIMATELY a year ago E. I. du Pont de Nemours and Co., Inc. announced in the U.S.A. the development of a new perfluorocarbon resin known as Teflon 100–X. This announcement has been followed recently by a further announcement that an experimental plant was being designed for the production of this resin and we are now able to give some details of this interesting material.

Teflon 100–X is a true fluorocarbon with a saturated structure consisting of fluorine and carbon. The generic term, perfluorocarbon, has been adopted by the company as an aid to distinguishing it from the Teflon tetrafluoroethylene resins.

The principal difference in the 100–X resin when compared with the other Teflon products is in the processing technique. With the new resin the melt viscosity has been reduced so that it is low enough for extrusion to be carried out on conventional and standard equipment at temperatures in the region of 200° C. No information is yet available as to the possibility of its use as an injection moulding compound although it would appear to have possibilities in this field.

Properties

Available information on Teflon 100–X emphasizes its chemical inertness and insolubility, and outstanding electrical properties. It is also notable for its strength and toughness as well as its weather resistance and nil water absorption figure. Parts fabricated from this material are suitable for continuous service at temperatures up to 200° C. and even higher under certain conditions.

Teflon 100–X is reported as being inert to practically all chemicals and solvents at temperatures up to 400° F. (204° C.). It has no known solvent, and is affected only by alkalis and certain complex halogenated compounds such as chlorine trifluoride at elevated temperatures.

Its electrical properties are outstanding. The dissipation factor is less than 0.0002 and the dielectric constant less than 2.2 over the entire spectrum measured to date (60 cycles to 60,000,000 cycles). Volume resistivity is greater than 10^{15} ohm–cm. even after prolonged soaking in water short time dielectric strengths are high.

Applications

Because of the comparative ease with which Teflon 100–X can be processed and its high temperature resistance it is anticipated that it will find many applications in aircraft and industrial wiring, pointed circuits, electronic components, bottles, liners and as a packaging material for corrosive chemicals. Small quantities of the resin are now available for experimental work and it is expected that commercial scale shipments will be available early in 1959. The present cost of the resin is $19.00 per pound.

Educational Facilities in Plastics

TRAINING facilities in plastics technology and related subjects are again available at many centres this September including the National College of Rubber Technology, Holloway Road, London, N.7, The Borough Polytechnic, Borough Road, London, S.E.1, Brunel College of Technology (Acton Technical College), Acton Hill, London, W.3, Newton Heath Technical College, Manchester, and Birmingham College of Technology. The majority of full- and part-time courses commence towards the end of this month, and full details of syllabuses, times of enrolment, etc., can be obtained by writing to the College concerned. Details of examination requirements, etc., for the examinations of the Plastics Institute can be obtained by writing to the Institute's Secretary at 6 Mandeville Place, London, W.1. A certain number of bursaries and scholarships are available and information about them is also obtainable from the Plastics Institute and also the individual colleges.

Brief details are given below of certain courses about which information has been sent in to us.

Borough Polytechnic

The following Courses will be offered for the Session 1957–58:—

(*a*) Two-year full-time course leading to the Diploma of the Plastics Institute.

(*b*) Four-year Sandwich course leading to the Diploma in Technology (with specialisation in Plastics) and Associateship of the Plastics Institute.

(*c*) Five-year part-time day course leading to the O.N.C. and D.P.I. qualifications.

(*d*) Four-year part-time day or evening course leading to the D.P.I. and the Full Technological Certificate of the City and Guilds of London Institute.

(*e*) Three-year part-time day or evening course leading to the A.P.I. for graduates and those qualified by H.N.C.

(*f*) Four-year part-time day or evening course leading to the A.P.I. for students with the D.P.I. qualification.

(*g*) Special one or two session evening courses in: (i) Plastics technology for graduates; (ii) High polymer chemistry; (iii) Plastics for technical sales representatives.

(*h*) Special laboratory courses in: (i) Plastics technology; (ii) High polymer chemistry.

National College of Rubber Technology

Full-time Plastics Associateship Course: A three-year course covering the syllabus for Associateship.

Day Plastics Associateship Course for Graduates: A one-year course for those with a degree of a British University in chemistry, or other approved qualifications.

Plastics Diploma Course: A two-year evening course for students of 17 years wishing to enter for the Intermediate and Final Plastics Examinations of the City and Guilds of London Institute, the Diploma of the Plastics Institute and the Certificate of the National College of Rubber Technology.

Part-time Day Release Plastics Associateship Course: A two-year course for graduates (or three-year for non-graduates) preparing for the examination for the Associateship.

Evening Plastics Associateship Course: A two-year course for graduates (or three years for non-graduates), qualifying them to take the examination for the Associateship.

Research: Provision is made for suitably qualified students to undertake research.

Newton Heath Technical College

Courses are available leading to the Diploma and Associateship Examinations. The course for the Diploma examination extends over four years and is taken concurrently with the Ordinary National Certificate examination in Chemistry.

Plastics Institute News

COUNCIL COMMITTEES

The constitution of Committees for Session 1957–58, as agreed by the Council at their meeting on July 30, is set out below.

Executive

A. Beecham, P. Morgan, J. Prior, L. M. Read, P. G. Rudd, C. W. Welch.

Finance

M. P. Brown, J. M. Clarke, T. C. Corbett, R. L. Douglas, A. B. Merriam, C. R. Todd.

Education

M. Apley, J. Butler, W. A. Cook, F. L. Hudson, A. O. R. Johnson, P. D. Ritchie, J. A. Rhys, G. Tolley.

Papers

M. Apley, T. C. Corbett, M. D. Curwen, M. Jones, P. Morgan.

Board of Referees

J. Butler, H. H. Lusty, J. Prior, J. Taylor, H. F. Wilson.

Design

J. K. White, R. E. Brookes, W. Bruce Brown, M. D. Curwen, R. P. H. Gillett, T. Gray, R. J. Mathews, P. Morgan, G. A. Rawcliffe, P. Reilly, M. O. Rowlands, A. H. Woodfull.

Council

The following were elected in the ballot for the four vacancies for Ordinary Members on the Council.

A. Beecham, A. O. R. Johnson, A. B. Merriam, P. Morgan.

EDUCATION CONFERENCE

Sir Miles Thomas, D.F.C., M.I.Mech.E., M.S.A.E. (Chairman, Monsanto Chemicals Ltd.), will be the main speaker at the Fifth Education Conference to be held at the Borough Polytechnic, London, S.E.1, on October 4, 1957. His subject will be "Challenge of Plastics to the Arts and Technology."

FOR THE FIRST TIME

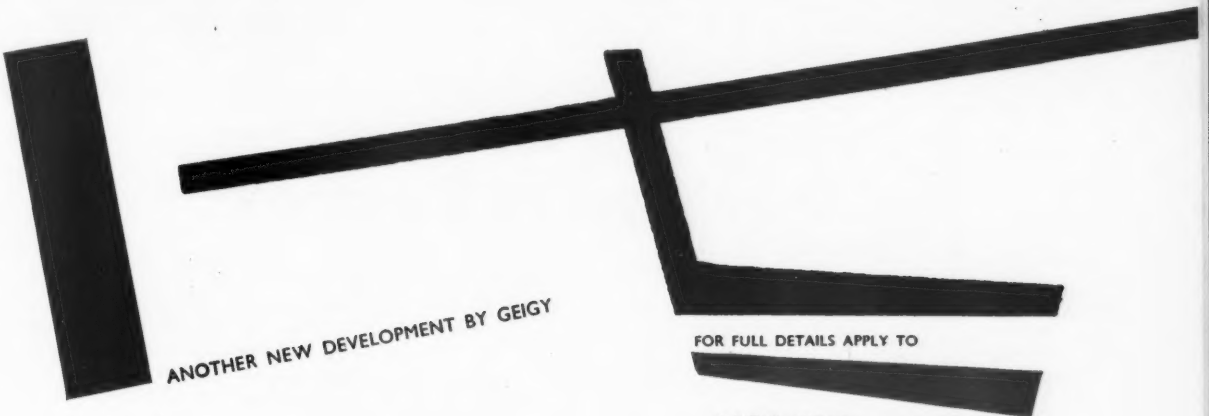
AN ORGANIC RED *fast to light and heat*

IRGALITE RED HGL SPECIALLY DEVELOPED FOR THERMOPLASTICS

FAST IN *full shades*

FAST IN *tint shades*

FAST IN *pastel shades*



ANOTHER NEW DEVELOPMENT BY GEIGY

FOR FULL DETAILS APPLY TO

PLASTICS CHEMICAL DIVISION OF

Geigy THE GEIGY COMPANY LTD. Rhodes, Middleton, MANCHESTER

Razor Blade Dispenser moulded in Lustrex by Gillette Industries Ltd.

Moulded in Lustrex

Lustrex polystyrene has grades for every purpose:
For toughness—and extra-toughness . . . Lustrex Toughened 3 and Toughened 11.
For vacuum-forming—Lustrex Toughened 6 for sheet extrusion.

For intricate mouldings—specially those needing a long flow . . . Lustrex Hi-Flow 55.
For dry colouring—to any shade you require . . . Lustrex Colourant Blend.
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303 Monsanto House, Victoria Street, London, S.W.1
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American Report

New Hercules Polythene Plant in U.S.A.

THE Hercules Powder Company new plant for making a new type of polythene, with a capacity of 30,000,000 lb per annum, is now ready for commercial production. Located at Parlin, New Jersey plant site, the plant is the first in the United States to employ the Ziegler process.

The new polymer, which has received extensive market development testing in the U.S.A., will be sold by Hercules under the brand name of "Hi-fax." In addition to providing the advantages of conventional polythene, Hi-fax is said to be harder, stiffer, more abrasion resistant, and also resistant to higher temperatures. Products made from Hi-fax can be sterilized in boiling water, a factor which is expected to lead to its use in many household products.

Additional advantages of Hi-fax when compared with conventional polythene are: higher density, and tensile strength, reduced permeability to gases and vapours, an increased resistance to environment stress cracking. It is also less affected by organic solvents and chemical reagents.

Hi-fax can be shaped and fabricated by injection, compression or extrusion moulding, as well as in vacuum forming.

Prior to the opening of the plant Hercules had sold in the U.S.A. over a million pounds of the new plastic material for extensive market development. This material was obtained through a two-way exchange agreement with Farbwerke Hoechst AG. of West Germany. Hoechst was the first company to translate Ziegler processes from the laboratory to commercial production.

Market Testing

As a result of extensive market-testing, many plastics manufacturers are already moulding in commercial quantities a variety of items from Hi-fax. The items include household goods, laboratory vessels, paint rollers, toys, containers, and nursing bottles. Industrial applications for the new plastic include wire and cable coatings, and pipe.

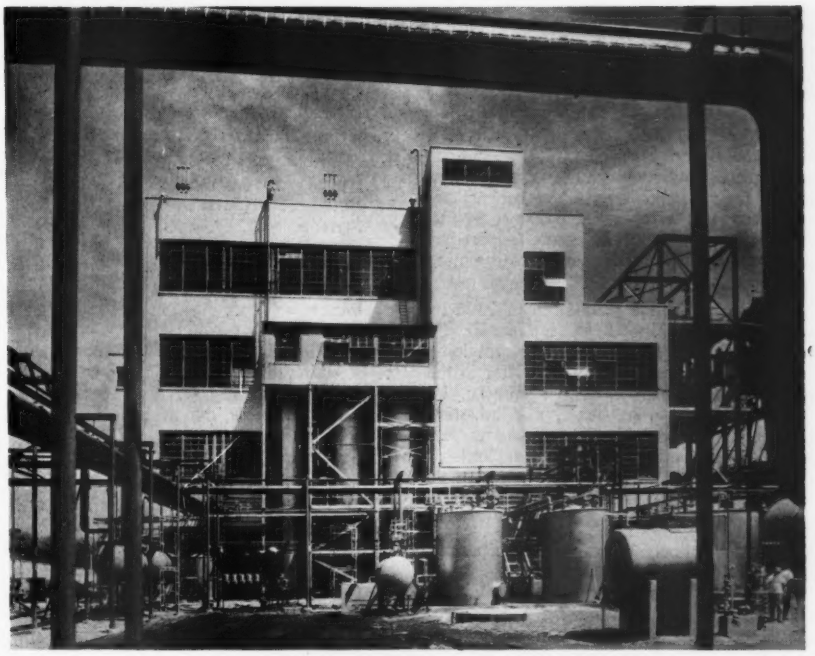
Esso Feedstock

The plant at Parlin uses as raw material, ethylene, which is delivered by pipeline from Esso Standard's refinery at Linden, New Jersey. The ethylene is polymerized at substantially atmospheric pressure, with the catalyst in a liquid, producing a slurry or suspension. The polymer is then separated from the suspending agent as a rather small particle-size solid material, purified and dried.

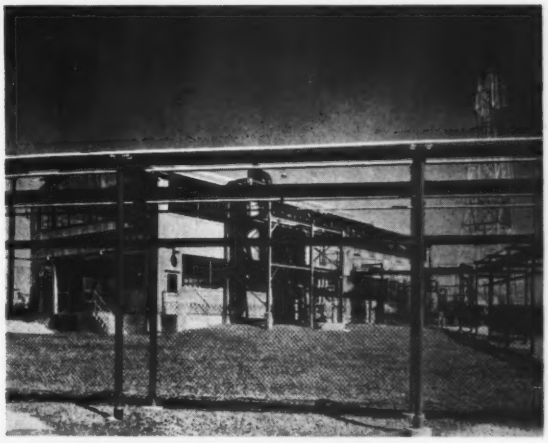
The polymer is then colloided and formed into pellets suitable for moulding. Hi-fax moulding powder can be either made natural or in colour.

The equipment used for polymerizing and for compounding the moulding powder has been designed specifically for this plant. Electric lines are insulated with Hi-fax, and parts made of the material are also used in the control system.

A small number of typical household applications are shown in the photograph on the right and include beakers, bowls and food covers.



(Above) Front view of the four-storey building of the new Hercules Hi-fax plant at Parlin, New Jersey. It is completely enclosed to provide optimum working conditions. Utilities and ingredient handling facilities appear in the foreground.



(Right) The semiworks section of the Hercules plant is adjacent to the main process area and is served by the same ethylene feed and utility connections.

Shown left is a display of household goods moulded with new Hercules polythene.

J

Synthetic Rubber—Part 2

By S. E. BOLAM*, A.N.C.R.T., A.I.R.I.

Following his review of the development of synthetic rubber, published in the July issue of "Plastics," pages 265-267, the author now discusses the polymerization, vulcanization, etc., of these materials

POLYMERIZATION of synthetic rubbers is, in the majority of cases, a free radical mechanism. Butyl rubber, however, is produced by an ionic mechanism. Most rubbers are polymerized as water emulsions, since by this method better temperature control is possible, and it is easier to copolymerize two or more monomers.

The polymerization reaction is initiated by a free radical obtained by the interaction of a mercaptan and a persulphate. The remaining unreacted mercaptan is employed later in the reaction as a chain transfer agent, i.e. by terminating a growing chain, and initiating the growth of another. This mercaptan/persulphate combination is the most usual initiator for the "hot" (122° F.) polymerization of butadiene copolymer rubbers.

The reactions involved are:—

(1) Reaction of persulphate with mercaptan to give a mercaptyl radical.

$$S_2O_8^{=} \longrightarrow 2SO_4^{\cdot}$$

$$SO_4^{\cdot} + RSH \longrightarrow HSO_4^{-} + RS^{\cdot}$$

(2) Reaction of the radical with a monomer unit, to give a monomer radical.

$$RS^{\cdot} + M \longrightarrow RSM^{\cdot}$$

(3) Reaction of this radical with other monomer units.

$$RSM^{\cdot} + {}_nM \longrightarrow RSM^{\cdot}{}_{n+1}$$

This reaction continues until the chain is terminated. This may be by one of three methods.

(4) Termination reaction.
- (*a*) Reaction with another radical.
- (*b*) Reaction with a molecule of chain transfer agent.
- (*c*) Reaction with an inhibitor.

Normally reaction (*b*) is the most common, where the mercaptan terminates one chain and initiates growth of another, thus:

$$RSM^{\cdot}{}_{n+1} + RSH \longrightarrow RSM_{n+1}H + RS^{\cdot}$$

In these formulae M stands for butadiene or styrene.

Polymerization is usually allowed to continue until a conversion of 70 to 80% of the monomer has been obtained. Then the reaction is finally terminated by addition of an inhibitor (the so-called short stopper), such as hydroquinone.

An antioxidant such as phenyl-beta-naphthylamine is then added, and finally, the unconverted monomer is stripped either by boiling off or by steam distillation. The resultant latex is coagulated by the addition of a salt/acid, glue/acid or alum and the coagulum washed, pressed, and finally packed for shipment.

The mercaptan acts not only as a component of the initiator, but tends to control the side chain development and the length of the individual chains, resulting in a softer and more easily processed material: but even so, the product is inferior to natural rubber both in processing characteristics and mechanical properties.

A typical recipe for "hot" GR-S rubber is:—

	Parts by weight
Butadiene	71
Styrene	29
Potassium persulphate	0.23
Dodecyl mercaptan	0.45
Emulsifier (fatty acid soap)	4.3
Water	180.00
Reaction temperature	122–130° F.
Reaction time	13–15 hours
Conversion	72%
Final butadiene/styrene ratio	76.5: 23.5

A lower polymerization temperature gives a product of higher average molecular weight, and at the same time, limits the formation of side chains, and the production of very low and very high molecular weight fractions. This greater uniformity of structure tends to give improved processibility, and better mechanical properties.

There are three main catalyst systems for this type of polymerization.
- (*a*) Diazothioether systems.
- (*b*) Hydroperoxide/iron complex systems.
- (*c*) Polyamine systems.

(a) Diazothioether System

This system, in which an attempt is made to couple the modifying properties of mercaptan with initiating powers of a diazo compounds, usually incorporates an oxidising agent such as potassium ferricyanide. Fast polymerizations at temperatures as low as —18° C. can be obtained, but the system is not widely employed, as the hydroperoxide/iron complexes are superior.

(b) Hydroperoxide/Iron Complex

The hydroperoxide/iron method is quite a complex one involving a hydroperoxide such as cumene hydroperoxide, a ferrous salt, potassium pyrophosphate and sugar. Mercaptan modifiers are also included. The ferrous salt, potassium pyrophosphate and sugar are mixed in the absence of air and added as a water solution, to the emulsified monomers. This solution is usually called the activator.

The system, in addition to being rather critical in control of the activator preparation, may lead to the presence of iron in the final rubber which may consequently tend to catalyse oxidation of the polymer. Nevertheless, it is used for the majority of the cold rubbers manufactured in the United States.

(c) Hydroperoxide/Amine System

In this method a hydroperoxide also is used but, instead of using the rather critical activator solution, a polyamine is employed. The polyamine must be of a particular type, i.e. one containing two primary amino groups, one or more secondary amino groups, and having not more than two carbon atoms separating the nitrogen atoms. The ethylene and 1: 2 propylene polyamines are particularly active. It is not considered that this system is entirely iron-free, but the iron content is sufficiently reduced to produce non-staining polymers. Complete elimination of iron complexes reduces the polymerization rate markedly.

Typical recipes for "cold" (41° F.) polymerization GR–S rubbers are as follows†:—

Iron Complex

	Parts by weight
Butadiene	72
Styrene	28
Water	200
Cumene hydroperoxide	0.01
Ferrous suphate heptahydrate	0.01
Dextrose	0.01
Potassium pyrophosphate	0.177
Daxad 11	0.10
Trisodium sulphate	0.5
Dresinate 214	4.5
Sodium hydroxide	0.10
Tert-Dodecyl mercaptan	0.17

Polyamine

Butadiene	72
Styrene	28
Water	200
Potassium fatty soap acid	4.7
Trisodium phosphate $12H_20$	0.8
Tamol N	0.15
Diethylene triamine	0.15
p-Menthane hydroperoxide	0.12
Ferrous sulphate $7H_20$	0.002
Versene Fe-3	0.02
Tert-Dodecyl mercaptan	0.20

Rubber Elasticity

The theory of rubber elasticity is a complicated one, and it is not intended to discuss it at length here. Many references to the subject can be found in the rubber and high polymer literature. A material will exhibit rubber elasticity if it consists of long chain molecules randomly distributed in a three-dimensional network, being held in that network by weak Van der Waals forces. These weak secondary bonds need to be reinforced by primary bonds in order to prevent flow and allow a rapid return to the state of random distribution after the molecule has been deformed.

In order to obtain this desirable three-dimensional random distribution, the atoms must be free to rotate and this necessitates relative freedom from crystallinity. It also follows that for there to be primary bonds along the polymer chain, there must be points of reactivity for cross-linking. Normally this is obtained by introducing carbon to carbon double bonds and by cross-linking with sulphur.

As rubber elasticity depends on the strength of the Van der Waals bonds, i.e. inter-molecular forces, it follows that elasticity is dependent on temperature, and this is in fact so. The elasticity range generally falls between —70° C.

*British Geon Ltd.

†Whitby. Synthetic Rubber, 1954. P. 217.

and +200° C. and this is one of the two distinguishing features between elastomers and plastomers. Plastomers, i.e. p.v.c., polystyrene, polymethylmethacrylate, have much stronger secondary bond forces than rubbers and consequently exhibit their elastic properties at much higher temperatures—unless these forces are weakened, i.e. by plasticization.

An indication of the practical utility of polymers as rubber can be obtained from their second order transition temperatures. In general, those for rubbers lie below 0° C. and for plastomers above. The following values give an indication of this:—

Elastomers

Polyisobutylene	—74° C.
Natural rubber	—73
GR-S	—61
Butyl rubber	—50
Polychloroprene	—35
Nitrile rubber	—23
Silicone rubbers	—120

Plastomers

Polyvinylidene chloride	—17
Polyvinyl acetate	+28
Cellulose acetate	+40 to +70
Polyvinyl chloride	+75
Polymethyl methacrylate	+62
Polystyrene	+81
Polyvinyl alcohol	+85

Of these the only polymer not exhibiting rubber-like properties and possessing a second order transition temperature below 0° C. is polyvinylidene chloride. At normal temperatures this material is highly crystalline and thus limits free rotation of the atoms, thereby curtailing elasticity.

One further material listed, polyisobutylene, is also not generally considered to be a rubber. This material has no unsaturation in the polymer chain, and is therefore incapable of being conveniently cross-linked with primary bonds—the second distinguishing feature. Polyisobutylene, although in itself elastic, has no marked resistance to stress, and thus tends to exhibit cold flow. If, however, cross-linking agents are introduced, as in the case of butyl rubber, which is a copolymer of isobutylene plus 2 to 5% of isoprene, sufficient unsaturation is provided to yield a product having rubbery elasticity on cross-linking.

Thus, for a material to exhibit rubber elasticity it must (1) be a long chain polymer having a coiled molecular configuration, and (2) possess points of reactivity spaced at intervals along the chain. For the more conventional rubbers this reactivity is supplied by carbon to carbon double bonds.

Before cross-linking, i.e. vulcanization, is effected, the polymer is thermoplastic, although not to the same degree as plastics, there being a certain elasticity which prevents the uniform flow normally experienced with the former materials. This inherent characteristic of the material, sometimes called "Nerve," affects processing. This is particularly evident in calendering and extrusion operations. As the stock is released from stress, i.e. the calender roll or extrusion die, the rubber molecules tend to regain their random configuration, resulting in the compound shrinking longitudinally with a corresponding increase in size laterally.

After vulcanization the material becomes thermoset in much the same way as certain plastics. That is to say, a three dimensional cross-linking has been achieved and the material develops its full rubber elasticity. The effect of introducing primary bonds is to increase elasticity, improve strength, resilience, resistance to cold flow, resistance to the influences of temperature, in fact, confer full rubber properties.

Unlike thermoset plastics, however, the amount of cross-linking is limited because, for a material to exhibit rubber elasticity, it must have freely rotating atoms. If all the double bonds along the chain are cross-linked, this would firmly lock the atoms into a solid three dimensional network and elasticity would cease to exist. In fact this is precisely the case in an ebonite, which is a hard brittle material at normal temperatures. Ebonite is essentially rubber plus 35% of sulphur.

Compounding

Before a rubber has any technical importance, it needs to be compounded with certain additives. The most important of these are vulcanizing agents, reinforcing fillers and antioxidants. This compounding step is usually accomplished on two roll mills or in internal mixers of the Banbury or Shaw Intermix type.

(1) Vulcanization

It will be appreciated that vulcanization is a most important reaction, converting a weak relatively useless material into a product which has revolutionized modern life. The reaction is predominantly the linking of two polymer chains by sulphur atoms. In order to effect this, heat is necessary. Even so, the reaction time is long and the product poor so far as physical properties are concerned, and it was not until the discovery of accelerators that rubber really became an important strategic material.

The use of accelerators not only reduces the vulcanizing time from hours to a few minutes, but also greatly improves the physical properties of the product, particularly the ageing characteristics. Accelerators vary in their accelerating power from relatively slow, i.e. for use with massive articles requiring a long curing cycle to ultra-fast where a full cure can be obtained at room temperatures only. In addition certain types of accelerators have a delayed action effect, i.e. they do not become active until a certain temperature is reached. This temperature is normally above that obtained during processing and thus a degree of safety against incipient vulcanization is afforded.

Representative accelerators are:

Slow	Thiocarbanilide
Medium	Diphenylguanidine.
Fast	Dibenzothiazyl disulphide
Ultra fast	Tetraethylthiuram disulphide.
Delayed action	Cyclohexylbenzthiazyl sulphonamide.

The amount and type of vulcanizing agent employed naturally varies according to the actual compound requirements, but the most commonly used combination is:—

Rubber	100
Accelerator	1–2
Sulphur	1–5
Zinc Oxide	5
Stearic acid	1

The zinc oxide and stearic acid function as an activator for the accelerator.

(2) Reinforcing Fillers

A vulcanized rubber, containing rubber vulcanizing ingredients only has relatively few uses. It is soft, highly extensible and elastic and lacks abrasion resistance. With all synthetic rubbers, with the exception of polychloroprene and butyl, mechanical properties such as tensile and tear strength are also very poor.

Consequently it is usual to include reinforcing fillers in the formulation. These materials increase hardness, tensile and tear strength, and improve abrasion resistance, in fact they generally up-grade the product. The amount of filler controls the extent of the improvement and for each polymer there is a definite optimum quantity. Above this quantity no further improvement is achieved in stress/strain characteristics although hardness is further increased.

The normal types of reinforcing fillers are the carbon blacks, of which there is a wide range each differing in various respects, and certain silicates. Few white fillers are truly reinforcing and for this reason most technical products are black in colour.

(3) Antioxidants

It has previously been stated that vulcanized rubber is not fully saturated; in fact double bonds which have been reacted with sulphur are small in number. There are thus many points of reactivity for chemical attack. Because of this, the majority of rubbers are prone to oxidation and ozonation. Additionally it is possible to modify the rubber molecule to yield a series of products ranging from flexible films to hard resins. This modification is achieved at the raw rubber stage, and it is not intended to discuss the processes here.

The attack by oxygen and ozone is, however, a serious disadvantage, and steps have to be taken to minimise the effect. Oxidation is a radical chain reaction and results in the breakdown of the long chain molecules causing what is generally termed "perishing."

This attack is minimised by incorporating antioxidants which function by interacting with the free radicals which initiate the chain reaction, to give relatively inactive products thereby preventing a serious attack on the rubber.

The effect of ozonation is apparent only in rubbers held in a stressed condition and results in large cracks perpendicular to the direction of strain. Until recently there was no effective chemical means of minimising the effects of ozone; waxes which bloomed to the surface, thus forming a protective layer, were used. Such a method was, of course, not entirely satisfactory, because if the wax film ruptured, ozone attack became concentrated at the point of rupture. Today, however, certain chemicals have been introduced which seem to be fairly successful in minimising this type of attack.

It will be seen, therefore, that a rubber compound is a complicated mixture of rubber, fillers, vulcanizing agents, antioxidants and other miscellaneous ingredients. A typical formulation could be as follows:—

Rubber Polymer (Natural or GR-S)	100.0
	(Parts by weight)
Carbon Black (filler)	50.0
Zinc Oxide (Activator)	5.0
Stearic Acid (Activator)	1.0
Sulphur (Vulcanizing agent)	3.0
Mercaptobenzthiazole (Accelerator)	1.25
Phenyl-beta-naphthylamine (Antioxidant)	1.0
Pine Tar (tackifier)	5.0

Inorganic Polymers

By J. A. BRYDSON,* A.N.C.R.T., A.I.R.I.

A literature survey of an interesting and important group of materials

THE increasing demand for heat resistant materials with the added requirements of toughness, flexibility and possibly, good insulating properties has recently reawakened interest in the subject of inorganic polymers. The purpose of this article is to review the references to inorganic and semi-inorganic polymers that are to be found in the literature and to indicate where possible, the potential applications of these materials. The silicates and glasses, the silicones and those allotropic forms of carbon, diamond and graphite, that might be treated as high polymers are considered to be outside the scope of this review.

Inorganic Polymers and the Periodic Table

The essential feature of a high polymer, whether used as a fibre, a paint, a plastic or a rubber is that it should be a large molecule built up from a number of fairly simple repeating units joined by a covalent bond. It is well known that the elements which tend to form covalent bonds are those in Groups 3 to 5 of the periodic table.

Group / Period	III	IV	V	VI
1st Short	B	C	N	O
2nd Short	Al	Si	P	S
1st Long		Ti Ge		Se
2nd Long		Zr Sn		
3rd Long		Pb		

Fig. 1. Fragment of Periodic Table showing some of the more important elements.

It may thus be expected that a number of these elements will be capable of forming high polymers and this in fact is found to be true. The literature references are, however, very limited although sufficient to show that a number of polymers species do exist (1) a number of which have actually been suggested for some commercial application. It is to be expected that developments of some of these polymers will find specialized uses in the important fields of plastics, rubbers and surface coatings.

Types of Inorganic Polymers.

The following types of polymers will be discussed:—

(1) Nitrogen-phosphorus polymers
(2) Organo-inorganic polymers
  (*a*) Organo-germanium polymers
  (*b*) Organo-tin polymers
  (*c*) Organo-lead polymers
  (*d*) Organo-titanium polymers
  (*e*) Organo-vanadium polymers
(3) Boron compounds
(4) Polymers of sulphur and selenium
(5) Silicon disulphide polymers.

Nitrogen-phosphorus Polymers

When ammonium chloride and phosphorus pentachloride interact at 125° C. a number of cyclic polymers (I) occur with a degree of polymerization from 3 to 7. If this mass is then heated to 300° C. the product (I) shrinks to give a rubbery mass often known as inorganic rubber (2, 9). This is believed to be a linear polymer of structure (II).

$$NH_4Cl + PCl_5 \xrightarrow{125°C.}$$

$$4HCl + \underset{(I)}{(PNCl_2)_x} \xrightarrow{300°C.}$$

$$\underset{(II)}{-PCl_2{:}\ W{-}PCl_2{:}\ N-}$$

If (II) is produced from the trimer isolated from (I), a tougher product is obtained (Fig. 2). "A" indicates the stress strain curve of the polymer prepared from the trimer, "B" indicated the curve obtained from the heterogenous product (I).

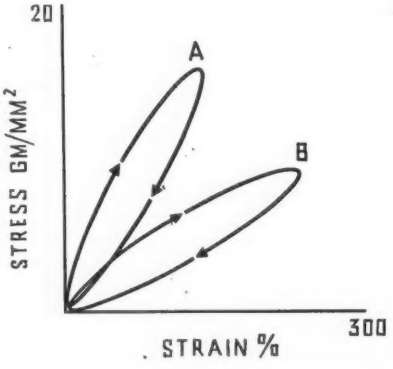


Fig. 2.

The polymer produced from the mixed product (I) swells to a greater extent in benzene and crystallizes more slowly than the polymer prepared from the pure trimer.

On stretching, the polymers become opalescent and develop an X-ray diffraction pattern that disappears on release of the imposed stress (3). This indicates that the rubber crystallizes on stretching.

The possible commercial value of these materials would appear to be limited by the chemical reactivity of the chlorine atoms. In the case of the trimer the following reactions occur (1).

$$(PNCl_2)_3 + 6H_2O \longrightarrow [PN(OH)_2]_3 + 6HCl$$

$$(PNCl_2)_3 + 4NH_3 \longrightarrow PN_3Cl_4(NH_2)_3 + 2NH_4Cl$$

$$\xrightarrow{8NH_3} [PN(NH_2)_2]_3 + 4NH_4Cl$$

$$(PNCl_2)_3 + HY \longrightarrow (PNY_2)_3 + 6HCl$$

where Y = N_2H_3, or, NHR or NR_2

Low molecular weight polymers of the $NPCl_2$ type have recently been the subject of a number of patents for use as flame proofing agents for textiles (5, 6).

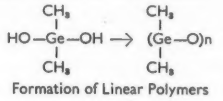
Polymers of the type $(PNF_2)_x$ (1) and trimers of the type $[PN(C_6H_5)_2]_x$ (4) have also been prepared, the latter being said to be stable at 500° C.

There has been theoretical as well as commercial interest in these materials recently. The solution polymerization mechanism has been studied (7) and the theory of high elasticity has been applied to inorganic polymers including those of the $NPCl_2$ type (8).

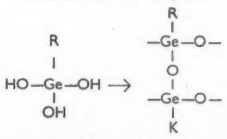
Organo-germanium Polymers

Germanium occurs below silicon in Group 4B of the periodic table. It is not therefore surprising that organo-germanium polymers similar to the organosiloxanes exist (10, 11, 12, 13). Like their silicon counterparts the alkyl germanium diols spontaneously polymerize to form insoluble materials which degrade in vacuo to give the trimer. Aryl diols also polymerize spontaneously to give polymers with no definite melting point.

Organo-germanium triols, which like the diols are prepared from the corresponding chloride also spontaneously dehydrate to give a three dimensional polymer which does not melt at 300° C. There is, however, some decomposition when heated in vacuo.



Formation of Linear Polymers

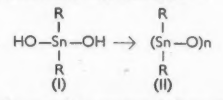


Formation of Cross Linked Polymers

There would appear to be no reference to the use of these materials for commercial purposes.

Organo-tin Polymers

A number of organo-tin polymers are known to exist although they are not so easy to prepare as the silicon and germanium counterparts (10). Alkyl diols of the type (I), polymerize to give linear polystannoxanes (II), unless R contains a tertiary grouping, e.g. $(CH_3)_3C-$.

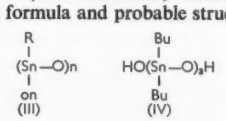


The diols may be prepared from the corresponding dichloride, from distannonic acids of the type $R(SnO_3H)_2$ (16), and by the following procedure (14):—

$Sn(OH)_2$, aqueous alcohol, caustic potash and ethyl iodide are reacted for 6 to 8 hours after which the alcohol is distilled off. Carbon dioxide is passed into the reaction vessel and a white amorphous polymer is formed.

The polymers are said to be insoluble in dilute HCl and stable to 360° C., decomposing before melting. The aromatic diols also produce analogous polymers that do not melt below very high temperatures.

Tin triols also dehydrate to give polymeric compounds (stannonic acids) which have an empirical formula and probable structure (III)

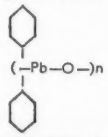


* National College of Rubber Technology.

Organo-tin polymers have been suggested as stabilizers for P.V.C. For example, the diacetate of (IV) can be used in quantities of ½ to 1% on the polyvinylchloride. In the case of this particular material, it is stated that higher polymers may be obtained by blowing moist air through (IV) at 140° C. (15).

Organo-lead Polymers

Very little is known of these polymers beyond the fact that some have been prepared (10), such as diphenyl " plumboxane "

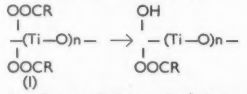


Plumbonic acids analogous to the stannonic acids are also known. There appears to be no reference to the commercial applications of these materials.

Organo-titanium Polymers

There are a number of references to such materials in the patent literature.

Polymeric titanium carboxylates are suggested as surface acting agents, dispersing agents, water repellants and rust inhibitors (17–20, 25). These compounds are of the type (I), where for example R = $C_{17}H_{35}$.



Hydrolysis of one of the carboxylate groups may be effected to give compounds of type (II) which may be cross linked via the hydroxyl group.

A number of organic derivatives or orthotitanic acid may be polymerized by treatment with water in an organic solvent (22).

For example tetrabutylorthotitanate on reaction with water at 60° C. in butyl alcohol will give a polymer. Products ranging from liquids to solids may be obtained by varying the type of derivative and the amount of water used. Polymers of this type have been suggested as drying oil accelerators (21), as a snubbing layer to bind gelatine to photographic films (24) and paper, and as modifiers for resin polymers (23).

Copolymers of organo titanium and organo silicon compounds have been suggested as water repellants for textiles, as curing agents for aldehyde type polymers and for photographic snubbing layers (23).

Organo-vanadium Polymers

There is a reference to the use of organo-vanadium polymers for rust inhibition (25).

Boron Compounds

Work is now being carried out in an attempt to produce boron polymers, with it is hoped, good temperature resistance. In particular, boron-phosphorus compounds have been studied, but it is understood that only low polymers such as $(PH_2BH_2)_3$ have been prepared (4). This particular trimer is stable to 250° C. It is also hoped that products with phenyl and halogenated side chains will be prepared because of their anticipated high temperature resistance.

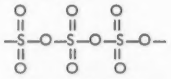
Sulphur and Selenium Polymers

If molten sulphur which has been held at 250° C. is chilled, a rubbery mass of " plastic sulphur " is formed. This product may be drawn and cooled to produce a fibrous material giving X-ray spots, but which on reheating to 70° C. regains its elasticity. Similarly, selenium may be supercooled from the molten state to give a material that is rubbery in the temperature range 70–73° C. (27).

The above materials are considered to be linear polymers of the following structure:—

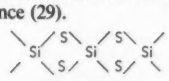
-S-S-S-S-S- -Se-Se-Se-Se-Se-

Sulphur trioxide in sulphur dioxide polymerizes to give a flexible and essentially fibrous material which is believed to possess the following form (28):—



Silicon Disulphide

Zintl and Loosen (1935) produced a silicon disulphide polymer which like the S and Se polymers are not known to be of any industrial importance (29).



Conclusions

Several inorganic polymers have been prepared, many of which have very good thermal stability. In some compounds such as the $NPCl_2$ type of polymer it appears that the high polymer is the stable form at high temperatures. At lower temperatures, unfortunately, it would appear that the monomers and lower polymers of some of these compounds are more stable.

Some commercial applications have been suggested for some of the polymers described but none have so far been suggested for plastics purposes. Since many of the polymers described have only been prepared in small quantities information concerning the technological properties is very limited.

It would appear that the subject of inorganic polymers is worthy of further attention, particularly with a view to applications where cost is of secondary importance.

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Best of Both Worlds

New Boatbuilding Technique

TRADITIONAL methods of boat construction, which have continued almost unchanged for generations, were supplemented soon after the war by the introduction of moulded plywood techniques, developed from experience gained in certain forms of aircraft manufacture. Moulded plywood methods, in turn, have been supplemented by the more recent and quite revolutionary process involving the moulding of boats from glass reinforced plastics.

These various methods, the traditional and the contemporary, have tended in some boatbuilding circles to clash rather controversially.

A recent development—pioneered in their " V " craft by Messrs. G. K. Varley & Son, of Pett, Hastings—however, manages to combine the best features of both the old and the new processes. The craftsman skill of the traditional boat-builder is embodied in the construction from hardboard of a hard-chined outboard rowing dinghy. The dinghy is then sheathed, or " skinned " with Duraglas glass fibre cloth and polyester resin, which imparts to the craft all the advantages associated with glass reinforced plastic material—great strength, stiffness, impact resistance, complete impermeability, resistance to marine fouling, and a very attractive appearance.

The first step in this new process is the construction of a wooden moulding former. On this are set up, in such a way as to facilitate subsequent removal, a laminated wooden keel and steamed wooden stringers forming an English oak boat frame with mahogany transom. This frame is held in the former and fixed in hard-chined shape by the skilful use of a marine resin and screws. Cut shapes, of $\frac{3}{16}$ in. thick waterproof tempered-pressed board, are then fitted to this rigged frame.

Additional framing, knees, and open slatted thwarts are then fitted to the hardboard hull. It is at this stage that the sheathing with glass reinforced polyester commences. To assist them in the technical problems associated with this special aspect of their process, Messrs. Varley called in Turner Brothers Asbestos Co. Ltd., manufacturers of Duraglas materials, who recommended a quality of woven glass fabric which has proved to be ideally suited to this application.

In the sheathing operation, a " gel coat " of polyester resin is applied over the whole of the outer surface of the hardboard hull. This " gel coat," consisting of a medium viscosity resin mix incorporating a pigment, impregnates and " keys " to the rough side of the hardboard and completely seals the surface.

The " gel coat " is allowed to set " tacky " and the Duraglas fabric is then laid into position on the hull and carefully smoothed.

After laying, the glass cloth is impregnated with polyester resin, which is then allowed to harden.

Patent Review

The following abstracts have been made from specifications at the Patent Office, with the permission of the controller of H.M. Stationery Office. The country of origin for Convention Applications is shown in parentheses. Complete specifications can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 3s. 6d. each (including postage).

B.P. 773,618. Ornaments for spectacle frames. C. E. Greatbach. To: Greames Optical Services Ltd.

A detachable ornament with a web on the lower edge for engagement between lens and frame.

B.P. 773,638. Method of forming pipe offshoots on pipes of thermoplastic synthetic materials. M. S. Fockens.

The pipe of, e.g., polyvinyl chloride is introduced into a surrounding mould which has a cut-out portion formed as a branching-off pipe. On heating the pipe and applying pressure the wall of the pipe will expand and enter the space of the branching-off portion. The closed end of this branch is then cut off so as to form the pipe offshoot.

B.P. 773,652. Toy building blocks. L. Hopmeier.

A hollow block of resilient plastic with an open side and tubular parts with dowel holes.

B.P. 773,707. Flexible tubing. J. Moseley. To: Compoflex Co., Ltd.

An inner and an outer helical wire coil and at least one layer or strip each of polyvinyl chloride and of Terylene film.

B.P. 773,718. Process for treating films made from solid polymers of ethylene. To: E. I. Du Pont de Nemours & Co. (U.S.A.).

Oriented polyethylene films are produced by rolling out the film in three successive stages at a temperature of about 70° C. The improved gloss and clarity and increased tensile strength and the better stiffness make the material particularly suitable as transparent wrapping material for foods, chemicals, textiles, hardware.

B.P. 773,719. Food containers. L. Beaumont.

A rectangular container of polystyrene, cellulose acetate, Perspex with pouring lip, handle and hinged lid carrying a lever projecting over the handle. The lid is raised by depression of the lever.

B.P. 773,761. Closure caps for collapsible containers. S. M. Alberdi.

The top of a screw cap for a collapsible tube carried a diaphragm which covers the top with resilient deflectable tongues directed towards the centre. On pressure, the tongues will lift and permit a portion of the contents to be discharged.

B.P. 773,778. Production of filament and film-forming polyethylene terephthalates. H. R. Billica. To: E. I. Du Pont de Nemours & Co.

Antimony trioxide as a catalyst greatly accelerates the rate of polymerization. The films are for use as wrapping materials, for packagings to be sterilized, glass replacements, polarizing films for automobile windshields and lamps, laminations, wall protectors and numerous other applications.

B.P. 773,809. Method of manufacturing shaped elements from urea-formaldehyde foam. To: Cogepa Etablissement Commercial (Switzerland; Germany).

For post-compression, the foam mass is continuously moved through a heated shaping device. The volume is reduced and the mass provided with a surface skin. For tubes, troughs, laminations.

B.P. 773,837. Apparatus for moulding blocks of plastic material on wires in the manufacture of components of multi-contact electromagnetic relays. To: Western Electric Co. Inc. (U.S.A.).

B.P. 773,843. Resilient support means for refills of vacuum flasks. To: Thermos (1925) Ltd. (Canada).

A moulding of polyethylene (or rubber compounds; vinyl copolymers) with a flared upper part to receive the refill and a lower resilient part to contact the bottom of the casing.

B.P. 773,885. Signs. Pearce Signs Ltd. J. H. G. Pearce.

The panel and the characters are of resins of different degrees of translucency (and contrasting colours). The characters are set in corresponding openings of the panel with interposed (stainless steel) outline mounts.

B.P. 773,897. Production of synthetic resinous condensation products and adhesives. To: Monsanto Chemical Co. (U.S.A.).

Oxides, hydroxides and alcoholates of the alkali metals and the quaternary ammonium bases as catalysts considerably accelerate the formation of polyurethanes from certain organic isocyanates or isothiocyanates. For use as an adhesive of markedly improved bond strength.

B.P. 773,922. Process for the production of derivatives of polyethylenes of high molecular weight. To: Farbenfabriken Bayer A.G. (Germany).

Reacting polyethylene with a halogen in the presence of maleic anhydride.

B.P. 773,925. Lipstick cases. G. Bompiani.

Cap and/or coupling member and/or bottom closure are made of transparent or coloured material to show the shade of the lipstick.

B.P. 773,929. Polyester resin castings. To: Columbian Carbon Co. (U.S.A.).

A polyester of maleic anhydride and ethylene glycol is dissolved in styrene.

B.P. 773,933. Temple mounting structure for spectacles. To: Bausch & Lomb Optical Co. (U.S.A.).

B.P. 773,938. Elastomer and polyvinyl resin blends. To: General Electric Co. (U.S.A.).

B.P. 773,977. Process for moulding so-called " plastic " materials. J. P. F. Smith.

The core remaining inside the moulded hollow article is made of a fusible alloy whose melting point is between 80° C. and 200° C., i.e. below the maximum temperature to which the plastic moulding can be subjected. Thus the core can be removed by heating so that it melts.

B.P. 773,983. Flexible hoses. W. A. Melsom, Bowden (Engineers) Ltd.

The inner tube is made of polytetrafluoroethylene, the cover tube may be of polyvinyl chloride or polyethylene or a silicone composition. The metallic reinforcement is made by braiding wires under tension on a rigid mandrel.

B.P. 773,986. Plasticized vinyl chloride resins. D. H. Coffey, E. A. Packer. To: I.C.I. Ltd.

Certain copolyesters are compatible with vinyl chloride resins and form a class of valuable non-migratory plasticizers.

B.P. 774,030. Method of perforating packets or bags made of polythene or like material. J. R. Whiteside. To: H. S. Whiteside & Co., Ltd.

For displaying bags filled, e.g., with nuts or sweetmeats, holes are usually punched through the " header " folded over the opening of the bag. To eliminate the uneconomic punching, the headers are prepared with a pair of holes overlying each other when folded over so that when fusing the end portions, the polythene film is exposed through these holes to the heated sealing jaws. The exposed film portion is destroyed by this contact.

B.P. 774,031. Process for coating a strand of glass fibres with a resinous material. To: Owens-Corning Fiberglass Corp. (U.S.A.).

A strand of closely adjacent glass fibres is pulled through a bath of resinous material. The threads are then fed through a die with the result that excess resin is removed and part of the remaining material squeezed between the fibres. Used, e.g., for producing insect screening.

B.P. 774,049. Production of laminated sheets or slabs of the sandwich type. To: Internationella Siporex AB (Sweden).

In a composite slab of a core of, e.g. lightweight concrete and outer layers of, e.g. wood or asbestos-cement plate, a synthetic resin adhesive is used hardening under heat and pressure (phenol-resol resins, melamine resins, carbamide resins, epoxy resins).

B.P. 774,054. Straps. A. Bayetto (Switzerland).

A rectangular strip with an eye and a grip member having special sections to be secured in loop form. As materials, polyethylene, polyvinyl chloride, etc., and metals are mentioned.

B.P. 774,056. Plasticizing cylinders for injection moulding machines. M. Maccaferri.

The main plasticizing passage is surrounded by a plurality of separate channels into which material is fed from the main passage and which discharge into the receiving chamber at the end of the main passage.

B.P. 774,061. Heating cylinders for plasticizing charges of plastic material. M. Maccaferri.

The main plasticizing passage is of constant effective internal diameter throughout its length. This passage is subdivided by radial ribs forming a plurality of radial passages around a central passage. A distributor of double cone construction regulates the mixing of the material in the main passage and is provided with heat conducting pads to produce an even flow of a melted plastic charge.

B.P. 774,062. Pastrycook's tool for shaping and ornamenting dough. J. A. Garrett (Australia).

With a dough-crimping section, a fluid applicator brush, a dough-cutting knife (and a crimping wheel) arranged to be combined with a rolling pin according to B.P. 650,229.

B.P. 774,097. Method and apparatus for embossing. H. Ewing, J. R. Wylde. To: British Celanese Ltd.

The surface of a film (plasticized polymer which can be softened to permit embossing by heat alone) is modified in heated condition (through radiant heat) by pressure between a travelling belt and a rotating drum. One of the surfaces is of a resilient material and has a different texture from that of the film. During travel round part of the drum the film is cooled to be stripped without destroying the surface effect.

B.P. 774,137. Spectacles for the use of television viewers. A. Abplanalp.

A frame with slidable eye-pieces of almost completely non-translucent material each with a narrow slit.

B.P. 774,161. Treatment of polyethylene. To: General Electric Co. (U.S.A.).

Polyethylene after irradiation with high energy electrons is subjected to a shearing or masticating action before being moulded. For extrusion (of wire insulation), moulding of sterilizable containers, articles resistant to solvents.

B.P. 774,279. Cocktail shaker. M. A. Hassid, E. Venis. To: British Vacuum Flask Co. Ltd.

A double-walled shaker avoids slipperiness of the outer wall by condensation through the existence of an air space between inner and outer container.

B.P. 774,370. Shoe provided with asymmetrical swimming webs. To: Ammafoco S.A. (Switzerland).

Web portion, side ridges and cavity are arranged symmetrically to a central plane so that the same swimming fin can be worn on either the right or left foot.

B.P. 774,417. Process for bending or folding sheets of plastic material. T. F. Rawls. To: Milford-Astor Ltd.

To a sheet rigid at normal temperature heat is applied only along a predetermined narrow rectilinear zone along which it is to be folded. On rending the material pliable, it is folded along this zone before any substantial tranference of heat to the adjacent zones.

B.P. 774,418. Delivering bags, envelopes, sheets, and the like. G. W. French, Beasley French & Co. Ltd.

For use with machinery making bags from, e.g. transparent or translucent viscose, regenerated cellulose and the like material.

B.P. 774,526. Manufacture of gramophone recording blanks. W. L. Rand. To: Electric and Musical Ind. Ltd.

Refers to a transferring mechanism between the coating of blanks (thin aluminium discs) with a nitro-cellulose lacquer on one or both sides and the drying of these blanks on supports which keep the coated cores spaced from one another.

B.P. 774,527. Method of and means for imparting pattern to thermoplastic films. H. W. Brock (Australia).

A printed coloured pattern is applied to a polyvinyl chloride film by extruding the hot film on to a backing member (paper of " bond " standard) bearing a colour-printed pattern, so that the film will pick up that pattern.

B.P. 774,535. Laminated articles. D. N. Davies, L. F. Bull. To: Distillers Co. Ltd.

Articles of bonded glass fibres formed in a mould or former of a rigid plastics material which will withstand any strains set up during curing of the bonding composition and which will then have become part of the produced article.

B.P. 774,557. Bird baths and like receptacles for attachment to bird cages. Hygienic Wire Works Ltd.; Mentmore Mfg. Co. Ltd.; P. Marshall.

Of plastics mouldings without cemented joints.

B.P. 774,587. Protecting means for working materials. F. Grau (Germany).

The carrier for a lastingly plastic corrosion-proofing substance for the protection of metal is a polyvinyl chloride (polyvinyl acetate; polyurethane) foil wound in form of a helical binding to the metal.

B.P. 774,650. Container fastening means. A. G. Fiocca.

A rigid bottom plate for ladies' handbags is made with an outwardly facing channel around the edge into which the ends of the upper and lower bag covers are inserted.

B.P. 774,713. Porous materials impregnated with synthetic resin and the production thereof. To: Dynamit A.G. vormals Alfred Nobel & Co. (Germany).

Shaped bodies (of graphite carbon) are impregnated with a synethetic resin in liquid form (phenol formaldehyde with furfural) which is then subjected to the action of a gaseous hardening agent (hydrogen chloride) and heat.

B.P. 774,754. Moulding compositions and articles produced therefrom. To: Monsanto Chemical Co. (U.S.A.).

Articles with a pearlescent surface made from isobutylene (95/99%) and isoprene (5/1%).

B.P. 774,759. Press for plates of synthetic material or fibres. W. Heumann (Kunstlederfabrik Dr. Heumann & Co.) (Germany).

To produce sheets, boards, plates of synthetic materials and fibres, first a fluid suspension is poured into a mould on wheels (cart). The cart stands to let the water drain off before pressing. In order to shorten the pressing cycle, one or more rotary tables are provided adjacent to the press.

B.P. 774,790. Production of porous flexible sheet material composed of adhesive and bonded fibres. To: Carl Freudenberg K.G.a.A. (Germany).

Porous sheets similar to textile material or leather are made from fibre fleeces with impregnants containing dispersions or emulsions of rubber and/or resilient resins. Fillers and heat sensitive substances, etc., may be present. The impregnants are solidified by heating. In the structure of the fleeces certain synthetic resin condensates are incorporated.

B.P. 774,805. Process for producing a thermosetting resinous moulding composition. To: American Cyanamid Co. (U.S.A.).

The thermosetting resinous material is first pulverized to a particle size within the range of 44–1410 microns and this material then introduced into a heating zone composed of a plurality of zones of different temperatures all above 20° C. but below 150° C. Continuous densifications occurs in this zone from which the densified material is extruded, cut into pellets and dried.

B.P. 774,807. Polyester resin compositions. To: Pittsburgh Plate Glass Co. (U.S.A.).

Refers to compositions of a polyester of a polyhydric alcohol and a polycarbolic acid, an aromatic compound having an unsaturated constituent, and a wax. Conventional polyester compositions cured at room temperature are not suitable for complex mouldings and where water-resistance is required (boats, automobile bodies, aircraft parts reinforced with glass cloth, etc.). It has been discovered that the incorporation of 0.001% of a wax (by weight of the polymerizable material) which is incompatible with the cured polyester results in the wax forming a very thin film on the cured body to give a hard, tackfree surface.

B.P. 774,810. Manufacture of exposide resins. J. R. Lewis. To: I.C.I. Ltd.

By condensation of dihydric phenols and halogen hydrins. The resin is first solidified and ground to a powder before the washing process.

B.P. 774,813. Moulded abrasive articles and method for producing them. To: American Viscose Corp. (U.S.A.).

Use of a chopped rag filler and a resin bond.

B.P. 774,891. Thermoplastics. Compra Plastics Ltd., R. H. Sturm.

Refers to printing, decorating, coating or bonding of bodies of vinyl, vinylidene and acrylic resins. An ink or cement is used including a solution of at least partly polymerized polystyrene, polyvinylchloride or certain other polymers having a softening temperature close to that of the base bodies. On removing of the solvent the ink or cement is fused with the base bodies by heat and pressure.

B.P. 774,903. Artificial eyes. J. H. Young, J. L. Attenborough. To: C. & L. Attenborough Ltd.

An implant for insertion within a natural eyeball with a magnetic link with a prosthesis. The implant may be moulded from methyl methacrylate.

B.P. 774,905. Storage and carrier container. C. H. G. Charlesworth.

For gramophone records, scientific instruments, etc., with two swivelling lid sections.

B.P. 775,035. Epoxide resin compositions. H. H. Beacham, K. M. Merz. To: National Lead Co.

A coating composition readily shipped and stored, of good flexibility, hardness, dielectric strength characterized by formation of clear transparent films, comprising an epoxy resin and an amine-complexed alkyl titanate.

B.P. 775,036. Manufacture of flexible hose. Compoflex Co. Ltd., P. W. O'Brien.

A mandrel is surrounded with layers of fabric (textile or glass fibre) to which, while on the mandrel a suspension (plastisol, solution) is applied of p.t.f.e. (or p.v.c. or rubber). The impregnated fabric is then cured and removed from the mandrel.

B.P. 775,038. Preparation of emulsions of polymers. S. A. Miller, R. A. W. Paleman, M. F. Ring. To: British Oxygen Co. Ltd.

Aqueous emulsions of polyvinyl acetate for the preparation of water based paints.

B.P. 775,061. Method and machine for forming fused seams in sheet thermoplastic material. To: W. R. Grace & Co. (U.S.A.).

Fusing is effected in two stages. First the heated jaws contact the sheets and close the seam (of a bag) lightly heating the material till it becomes plastic, then full pressure is applied so that some material is displaced and forms a thickened margin along the seam inside the bag.

B.P. 775,082. Electrical conductors insulated with polyesters. To: General Electric Co. (U.S.A.).

For magnet wires. A reaction product of 45 equivalent % (number of mols times number of functional groups) of dimethyl terephthalate, 33 equivalent % of ethylene glycol, 22 equivalent % of glycerin.

B.P. 775,149. Flexible stay especially for corsets. M. Ganser (Ditta Ved di Hans Ganser) (Switzerland).

A metal strip in a sheath of polyethylene, nylon, polyvinyl chloride.

B.P. 775,217. Packaging of beverages and liquids. L. Peters.

With a collapsible spherical portion and an outlet tube sealed thereto. The liquid and gas under pressure keeps the sphere expanded. Materials: vinyl-chloride-acetate copolymers, rubber hydrochloride, vinylidene chloride,

polyethylene, polyamides and their modifications.

B.P. 775,233. Pipe line of non-weldable synthetic plastic and a process for the manufacture thereof. To: Phoenix-Rheinrohr A.G. Vereinigte Hutten- und Röhrenwerke A.G. (Germany).

The ends of the pipes are provided with a weldable plastic collar fitted thereon so as to render them capable of being welded, e.g. pipes of glass reinforced polyester resin have collars of polyvinyl chloride.

B.P. 775,296. Bottle stoppers. M. A. Hassid, E. Venis. To: British Vacuum Flask Co. Ltd.

An improvement on the stopper described in B.P. 688,636, incorporating a threaded spindle attached to a dished base, a cap or nut, a centralizing disc and an annular stopper element to be expanded against the wall of the bottle neck by screwing down the nut. To prevent binding, the nut is of melamine formaldehyde, the disc and spindle of a polyamide thermoplastic.

B.P. 775,371. Method of and means for coating plastic materials. H. W. Brock (Australia).

Extruded plastics (polyvinyl chloride; polyethylene; styrene copolymer; rubber) are brushed (sprayed; blown on) while still hot, with metallic powder (or with dust or fibres of fabrics; with fine powders of plastics).

B.P. 775,373. Thermoplastic laminate. F. Groff; C. F. Martino. To: Union Carbide and Carbon Corp. (U.S.A.).

Polystyrene impregnated glass fibre mat and rubber-modified polystyrene are compressed together to form laminated sheets with smooth surfaces, uniform density, high impact strength, heat stability down to —100° C.

B.P. 775,377. Adhesive tape. C. R. Walls. To: Permacel Tape Corp.

With a facing material having at spaced interval pleats serving as tabs to facilitate stripping, e.g. when using double-sided adhesive tape to hold stereos on print rolls or mirrors in compact sets.

B.P. 775,395. Electric heating of flexible containers. V. Flax (France).

High frequency sealing by a current supplied through an oscillatory circuit controlled by the distance between the jaws pressing the parts to be sealed together. The sealing is effected only when the jaws are in final position.

B.P. 775,461. Resinous coating compositions. A. Abbey. Comm. from: Dow Chemical Co.

Refers to prime coats baked on washing machine (metal) parts exposed to laundry detergents. The coatings may be composed of a drying oil acid ester (of the hydroxyethyl ether of a novolak made from common phenol, and formaldehyde) and pigments or of the ester and up to 50% of a reinforcing resin such as melamine-formaldehyde or urea-formaldehyde, with or without pigments.

B.P. 775,500. Reinforced footwear and method of making same. To: United States Rubber Co. (U.S.A.).

"Slush moulded" footwear with a reinforced sole area with a heat insulating lining provided with an outer wear resistant shell.

B.P. 775,514. Process for making a sponge-like heat and sound insulating material from textile scraps. L. Sauer (Germany).

Polyamide scraps (1 part) are dissolved in concentrated hydrochloric acid (2.3 parts). The solution is strained, then spread in a thin layer (0.2 to 1.2 mm.) and immersed in a solution of sodium carbonate. The mass will froth and expand 10 to 15 times its original volume. The sponge obtained is washed and dried.

B.P. 775,562. Expanded plastic sheet material. R. S. Higginbotham, E. Mottershead. To: I.C.I. Ltd.

A plastic material (vinyl polymers and copolymers; vinylidene polymers and copolymers), a plasticizer, a solid blowing agent soluble in the plasticizer, a gelling agent (and pigments) are applied by a doctor knife to a (temporary) support (flexible sheet). The composition is heated until the blowing agent decomposes.

B.P. 775,639. Flexible pipe. J. Brand.

A strip of synthetic material with a reinforcing ridge adjacent to one edge is helically coiled so that the edge away from the ridge overlaps that portion of the next turn which is adjacent to the ridge. The ridge may be strengthened by an insert of greater rigidity.

B.P. 775,707. Floating toy. Cannon Rubber Manufacturing Ltd., D. Atkin.

Hull, deck and superstructure moulded in one piece by making the walls of a pressed-up hollow in the underside into a superstructure.

B.P. 775,726. Method and device for opening up tubes of flexible materials. To: Schweizerische Industrie-Ges. (Switzerland).

For production in a continuous operation, the flat tubes are moved relative to an outside carrier and an inside slider body which remains stationary relative to the carrier.

B.P. 775,739. Electric sockets or holders intended to be fixed against a wall. E. Chananbon (France).

Moulded of flexible or semi-flexible plastic material, the holder is provided with two integral studs insertable into two holes in the wall where they are elastically held.

B.P. 775,764. Plasticized polymethyl methacrylates. D. H. Coffey, D. J. Guest. To: I.C.I. Ltd.

B.P. 775,789. Manufacture by extrusion of tubes or hoses from plastic material. To: Nederlandse Organisatie Voor Toegepast-natuurwetenschappelijk Onderzoek ten Behoeve van Nijverheid, Handel en Verkeer (Netherlands).

An extrusion head is used with a cylindrical channel the ring-shaped outlet of which leads to the extrusion nozzle. Inside the nozzle is a mandrel surrounded by a flexible (steel) part adjustable to modify the size of the ring-shaped outlet.

B.P. 775,796. Smokers' ashtrays. R. Stockburger.

With two bowl halves to allow ash to slide into the receptacle. The halves are operated by finger pressure on a bearing ring.

B.P. 775,799. Dispenser. To: Gilette Co. (U.S.A.).

Helical bellows (vinyl plastics; polyethylene) constitute an axially compressible chamber. The dispenser (for cosmetics; hand lotions) can be secured to a bottle or other container.

B.P. 775,838. Joints in which flexible members made of synthetic organic polymeric material are joined to rigid members. D. W. Cripe. To: General Motors Corp. (U.S.A.).

It is difficult to join p.t.f.e. tubing to a metal tube. The difficulty is overcome by using the pressure of a spring band and a lightly roughened surface on the metal which must not show sharp edges.

B.P. 775,846. Floats for use in swimming. H. A. Yates. To: Lea Bridge Rubber Works Ltd.

Of the inflatable ring type, forming two resilient horns overlapping each other around an eccentric opening for the body.

B.P. 775,874. Treatment of polymeric materials. To: General Electric Co. (U.S.A.).

Irradiating with high energy electrons a material selected from copolymers of butadiene and styrene, butadiene and acrylonitrile, polyacrylic acid esters, polychloroprene, polystyrene and natural rubber.

B.P. 775,878. Coated textile fabrics. W. Abbotson, D. H. Coffey, R. Hurd. To: I.C.I. Ltd.

A flexible semi-transparent fabric resistant to solvents is obtained (for light weight tarpaulins; sun blinds), when a fabric, especially a fabric of synthetic fibres, is coated with a composition of polyhydric alcohol-polybasic acid condensation products and organic polyisocyanates with a particular mixed polyester as plasticizer.

B.P. 775,879. Coated polyester fibre fabrics. W. Abbotson, D. H. Coffey, R. Hurd. To: I.C.I. Ltd.

B.P. 775,900. Combined washing and cleaning appliance for hand use. W. A. McLellan. To: W. A. McLellan Ltd.

A translucent or transparent polythene container is combined with a detachable cleaning head carrying an annular ring with a brush to be provided with liquid through a diaphragm with slits. The cleaning head also carries a scraper.

B.P. 775,921. Phenol-aldehyde resinous compositions for use as electrical insulators. To: Westinghouse Electric International Co. (U.S.A.).

The arc resistance compositions may be greatly improved by the addition of 3/30% of finely divided inorganic refractory particles of an average particle size not exceeding 5 microns.

B.P. 775,938. Manufacture of flexible cellular material. To: Goodyear Tire & Rubber Co. (U.S.A.).

The liquid reaction mixture of an active-hydrogen-containing polymeric material, a polyisocyanate and water is distributed onto a casting surface inclined downwardly at 1/10° below horizontal.

B.P. 775,058. Waterproof material. V. O. Robinson. To: Robinson & Sons Ltd.

Sanitary pads and towels are made of a cellulosic soft, absorbent material (wadding; crepe paper) coated with polyethylene on one face.

B.P. 776,150. Armoured plastic tubes and their manufacture. A. Abeloos (France).

A thermoplastic tube covered with an uncoated reinforcing (metal) sheath is subjected to internal pressure and heat to become firmly adherent to the (non-thermoplastic) sheath.

B.P. 776,179. Plastic laminates. To: Celanese Corp. of America (U.S.A.).

At least one layer of fabric, one layer of a mat of fibres, one outer layer of fibres of a thermoplastic material. The outer plastic layer gives freedom from rough spots.

B.P. 776,276. Laminate materials and containers made therefrom. F. A. Richter. To: Tee-Pak, Inc.

A plurality of plies of thin flexible films, each adhering to an adjoining ply as a result of inherent attractive forces. The outer ply is transparent so that a printed face of the inner ply can be seen (double wound polyvinyl chloride film). For bags, tubes, sausage casings.

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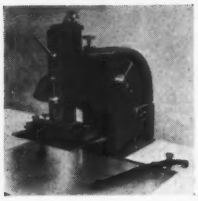

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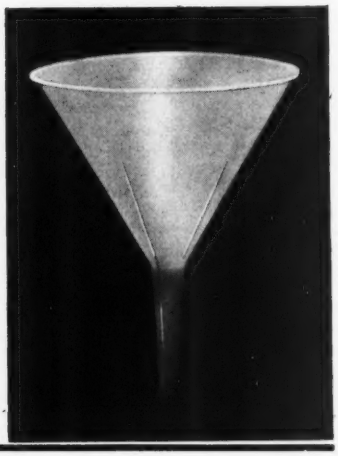

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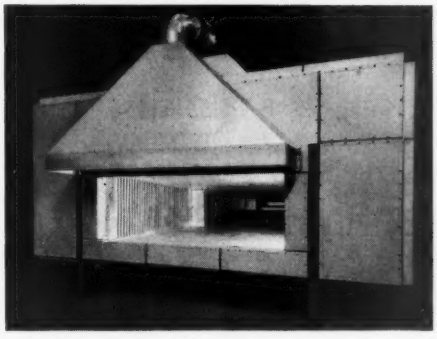

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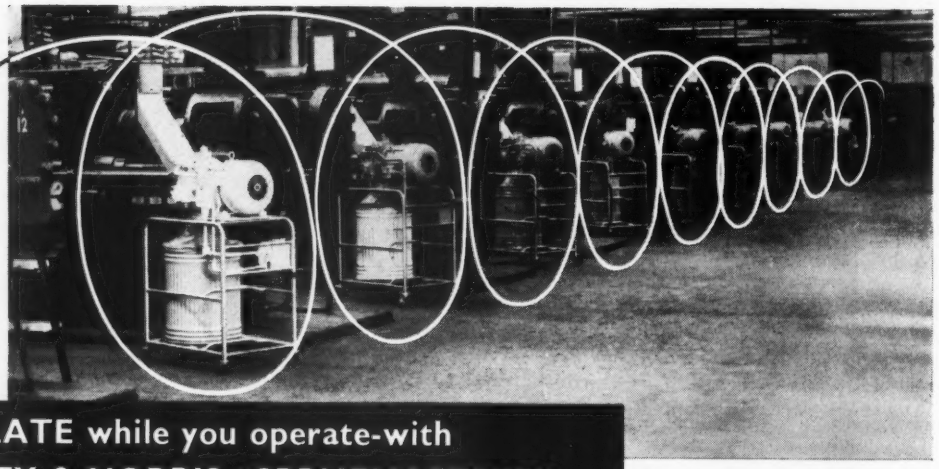

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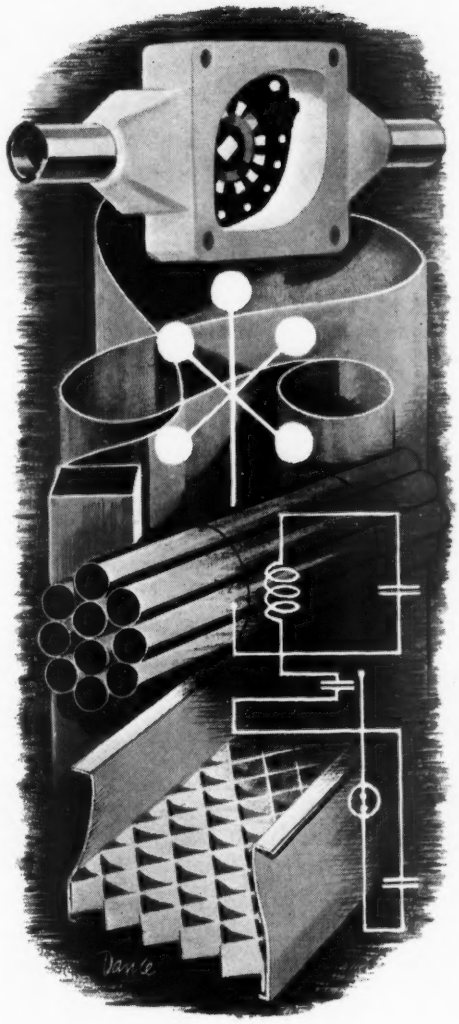

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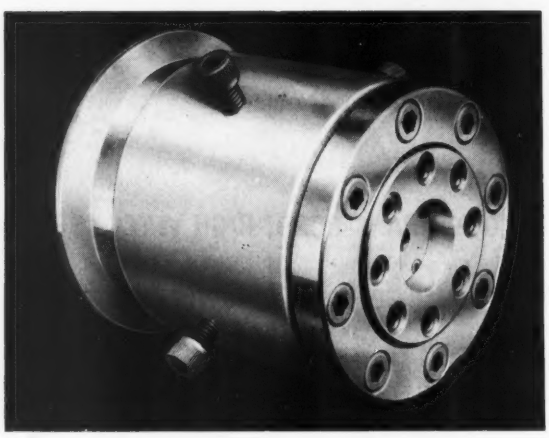

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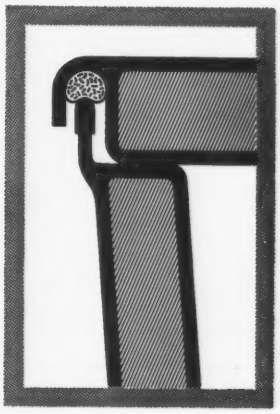

Cross-section of lid and side of container—showing Reinforced Plastic skin and resin-bonded insulation.

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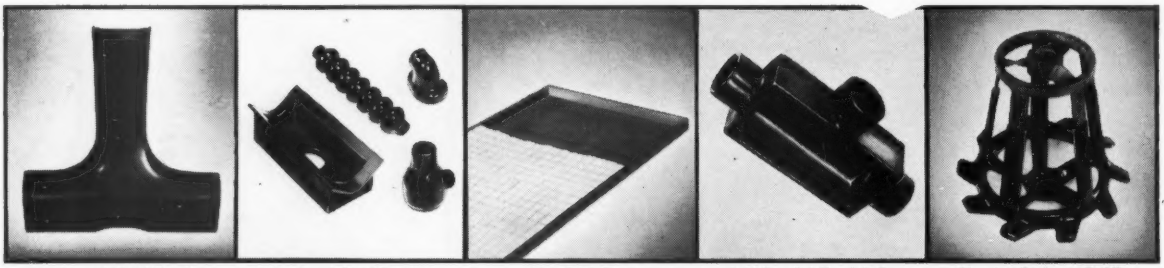

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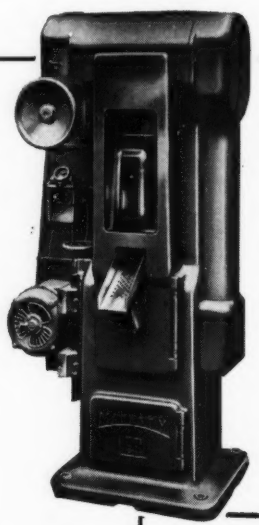

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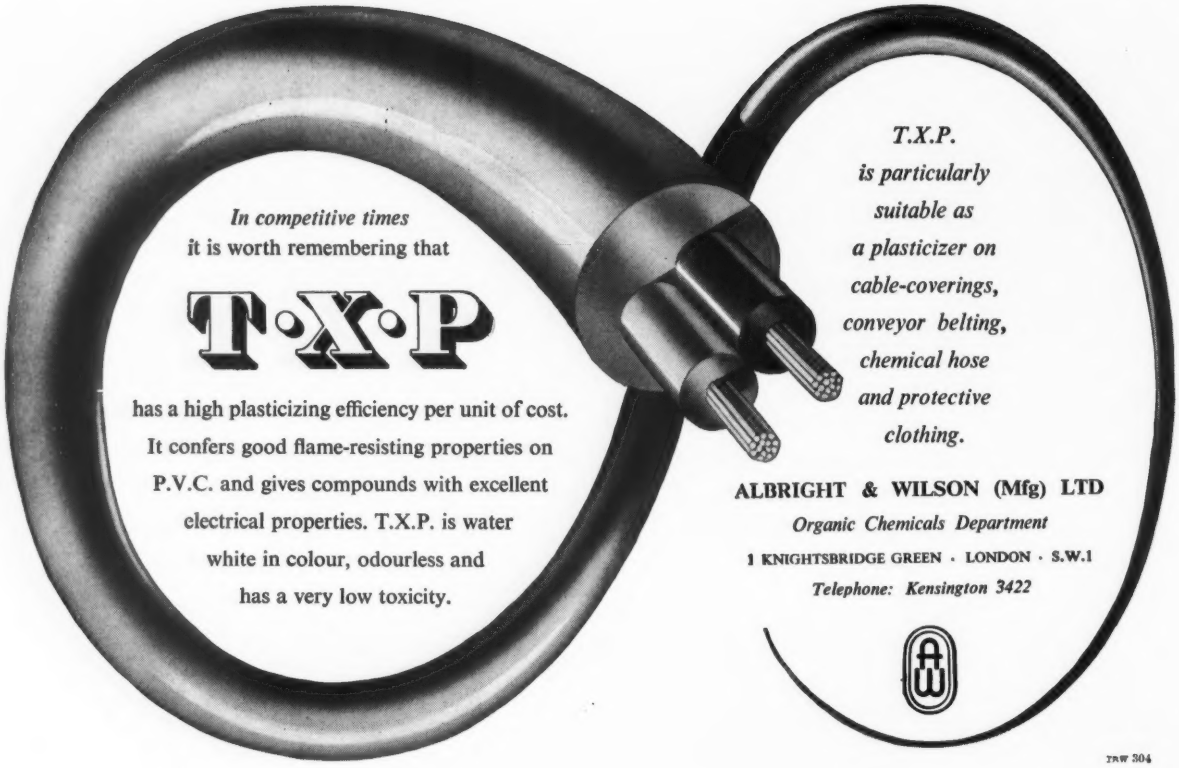
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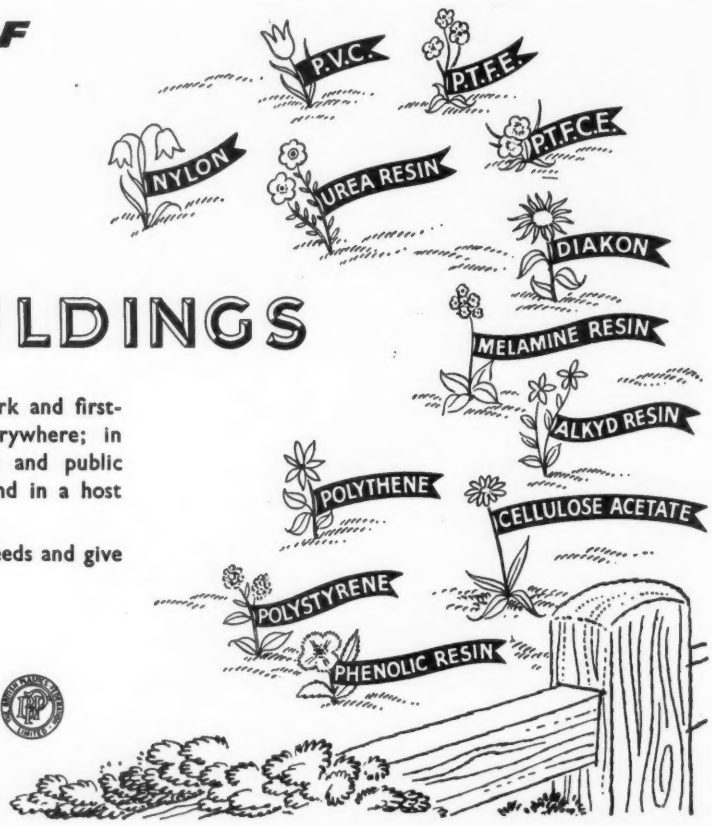

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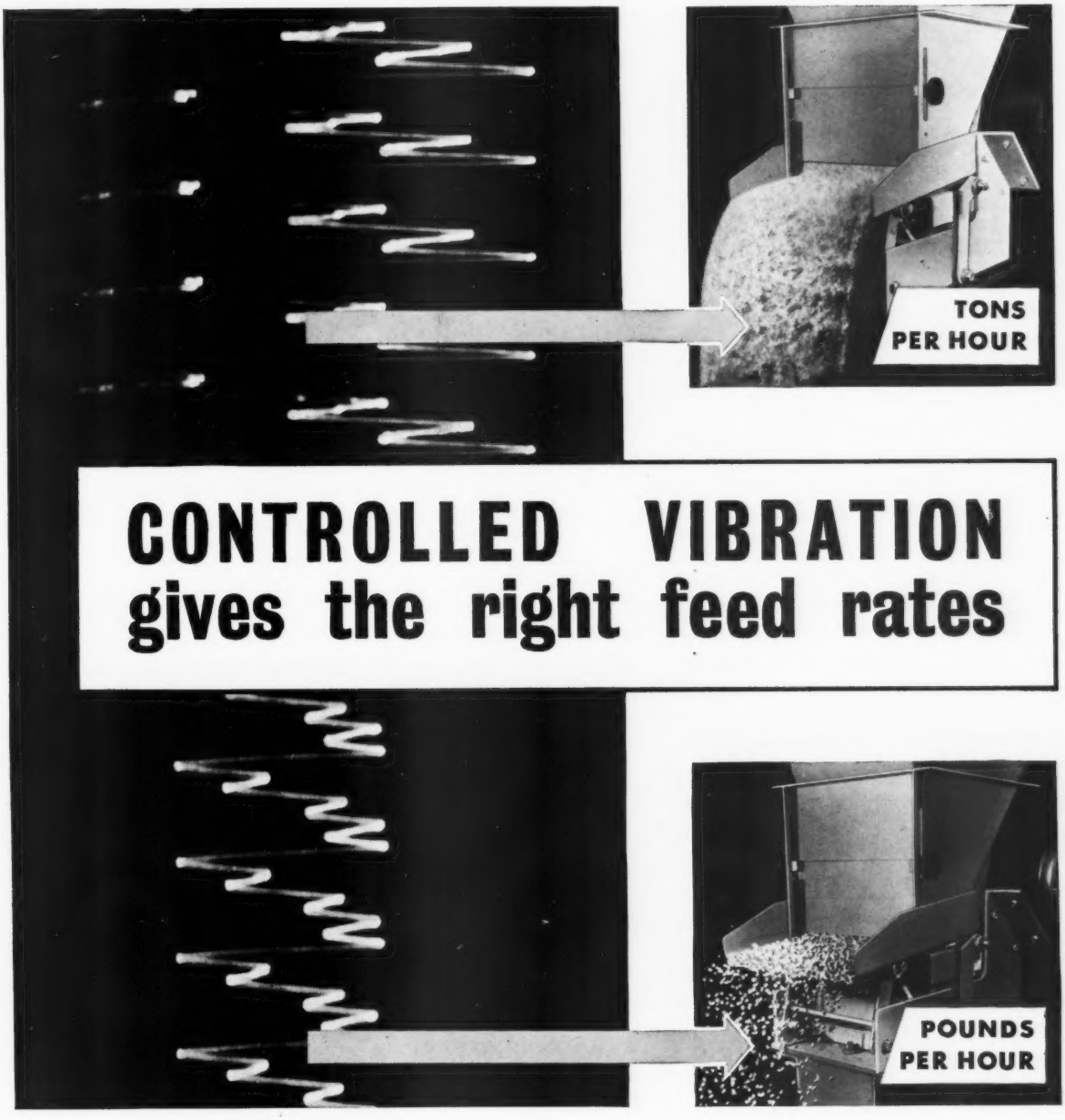

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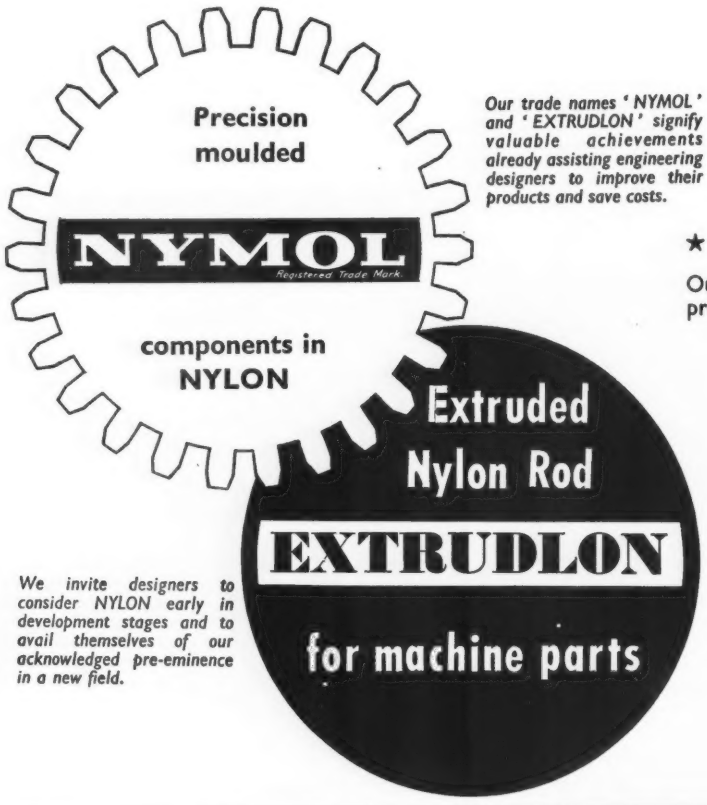

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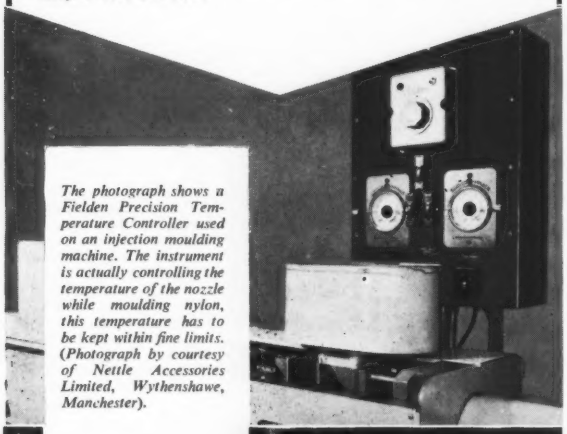
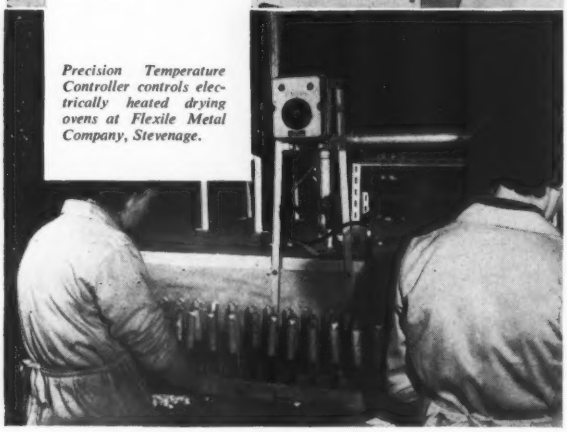


The photograph shows a Fielden Precision Temperature Controller used on an injection moulding machine. The instrument is actually controlling the temperature of the nozzle while moulding nylon, this temperature has to be kept within fine limits. (Photograph by courtesy of Nettle Accessories Limited, Wythenshawe, Manchester).



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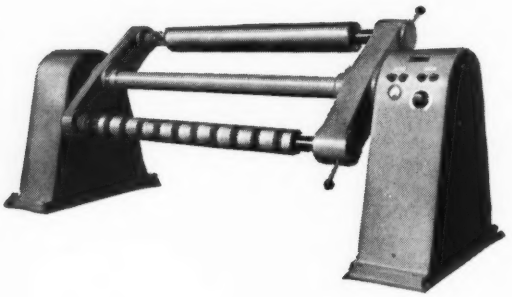

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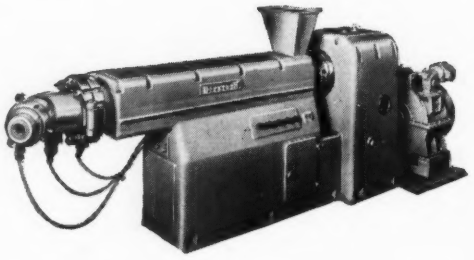

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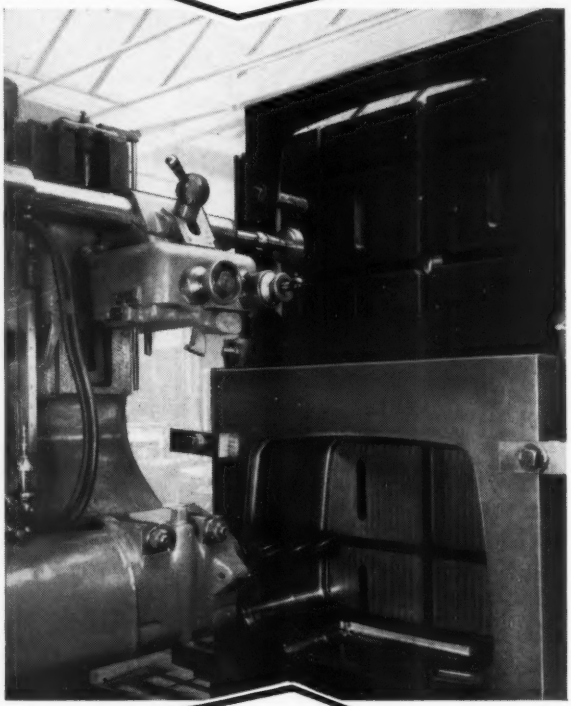

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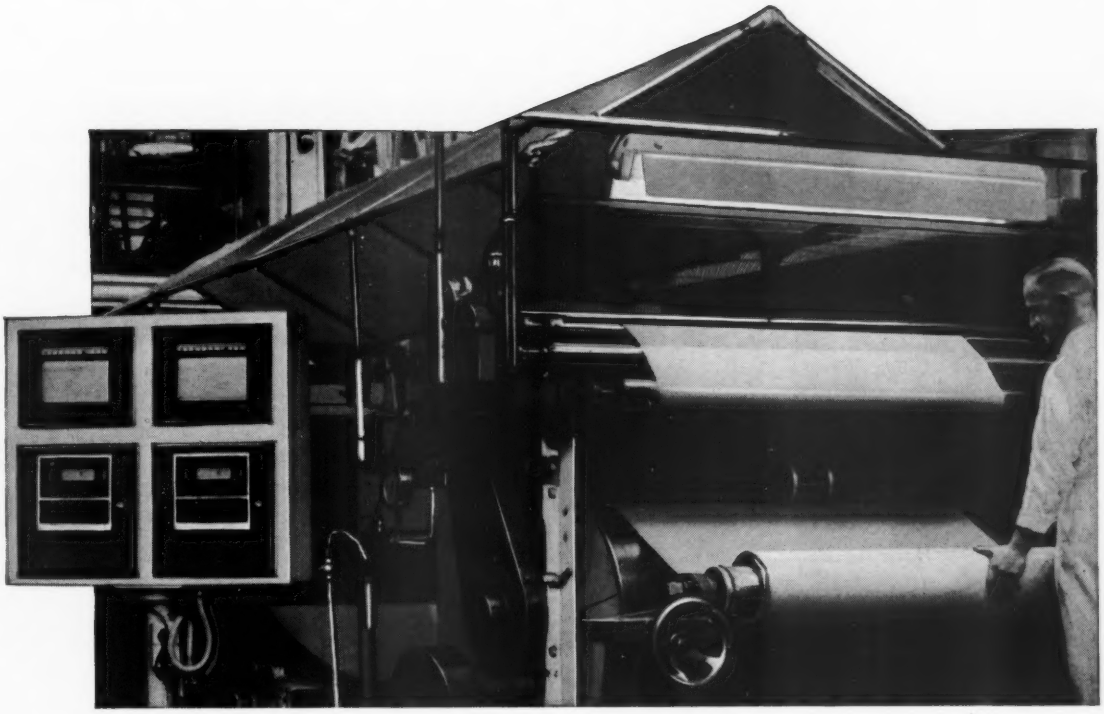

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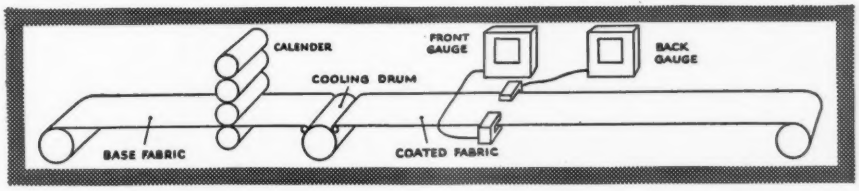

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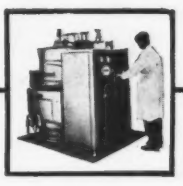

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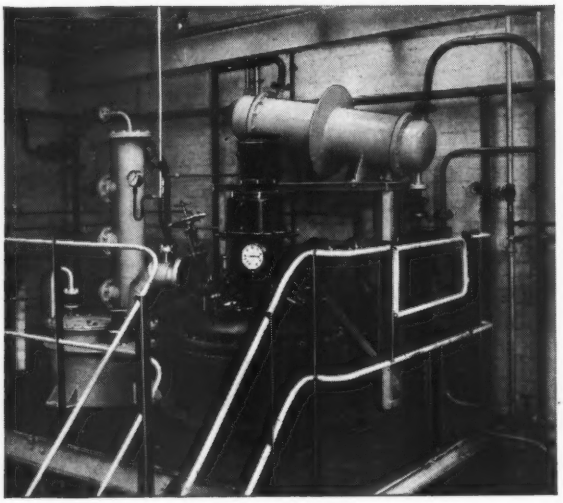

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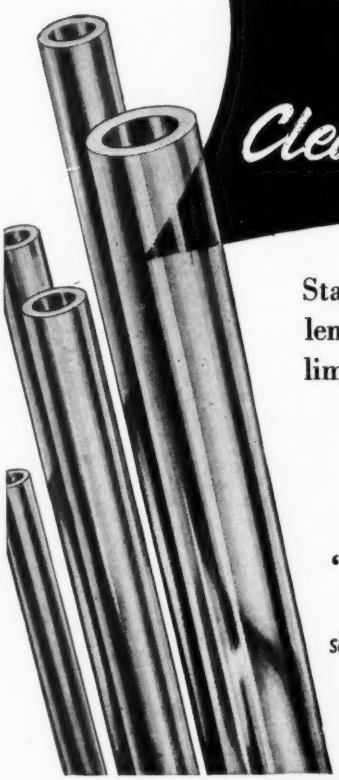

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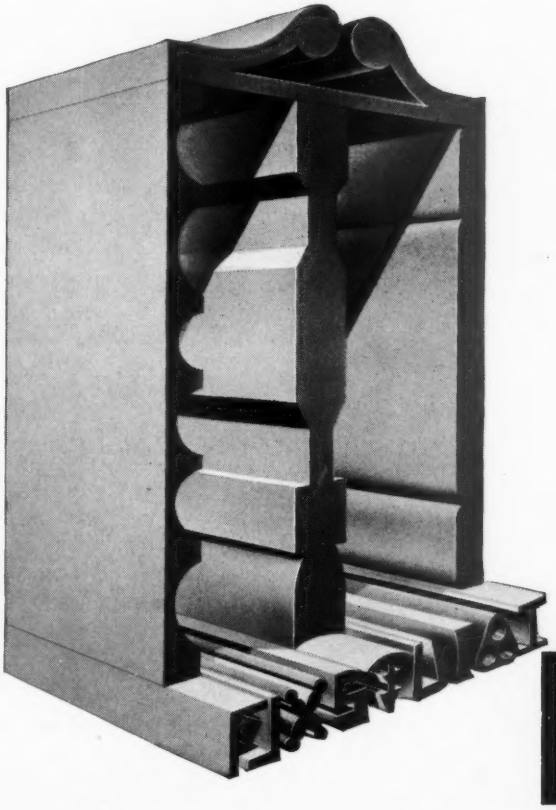

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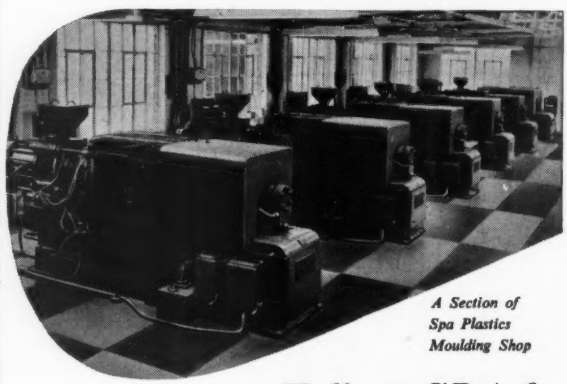

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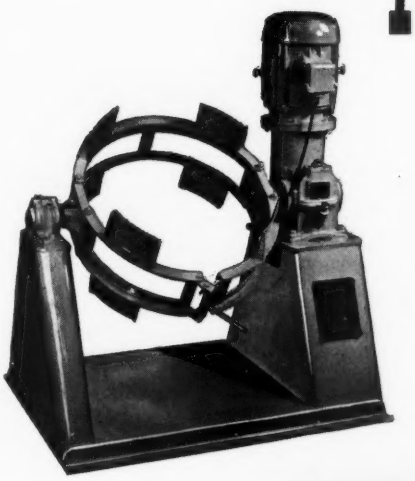

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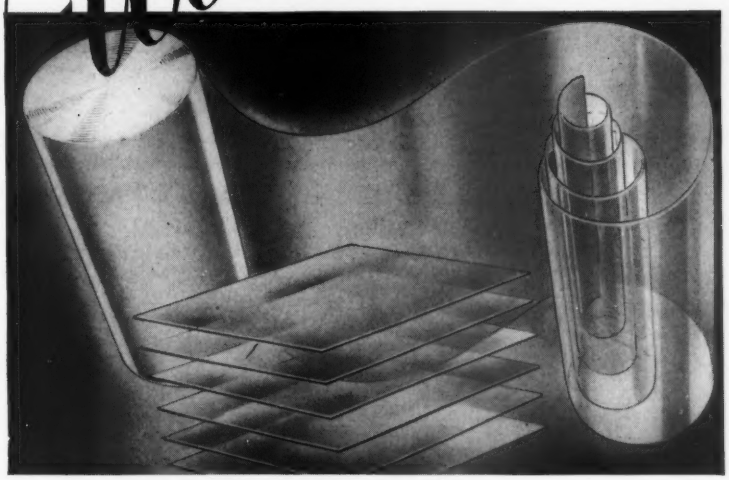

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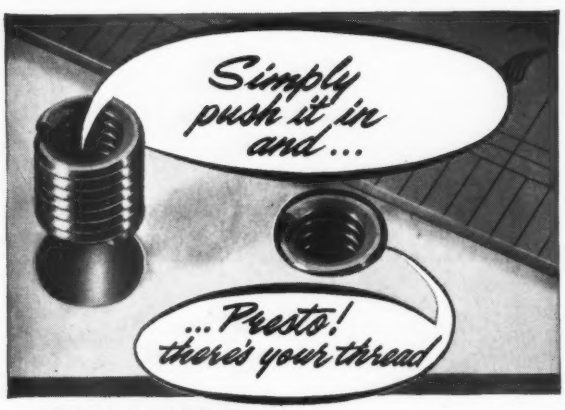

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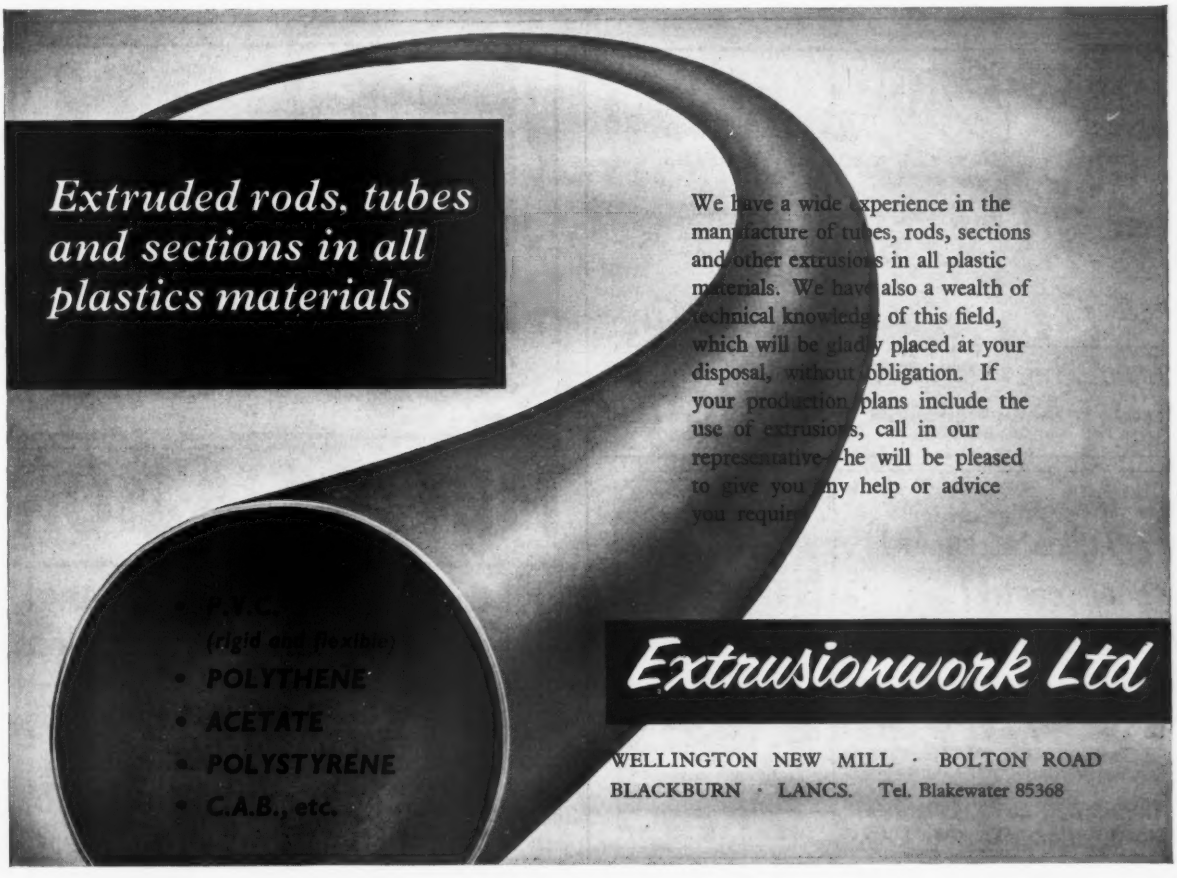
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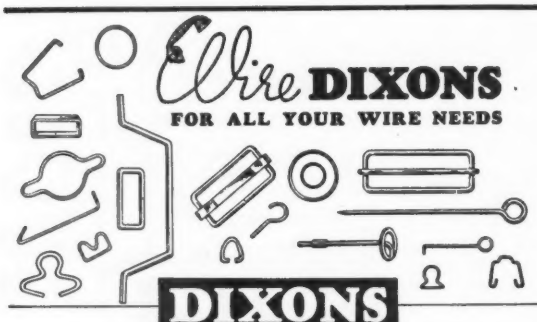

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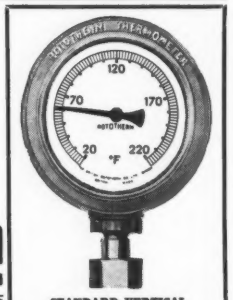

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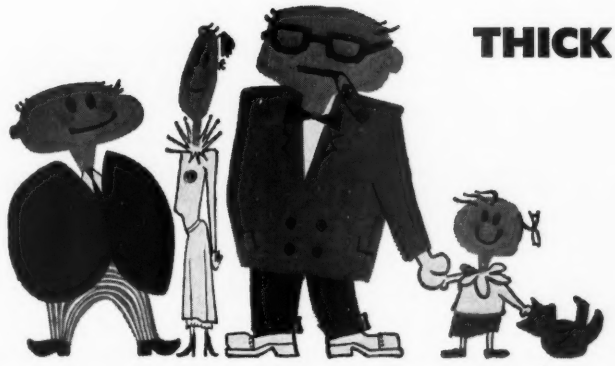

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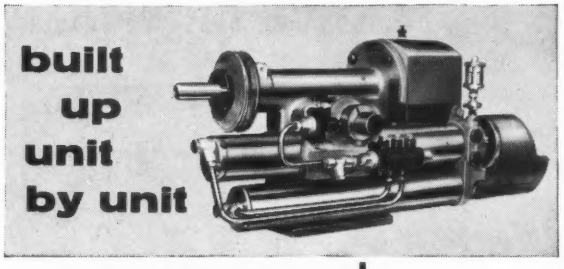

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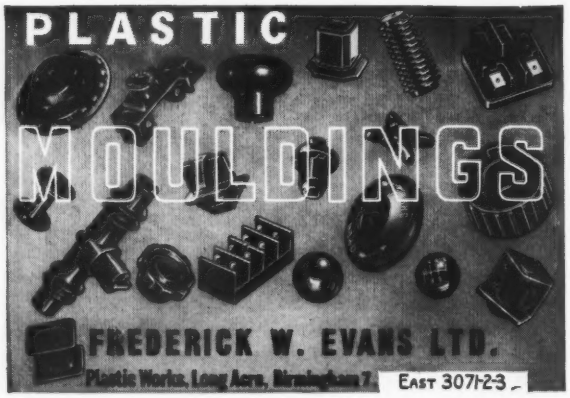

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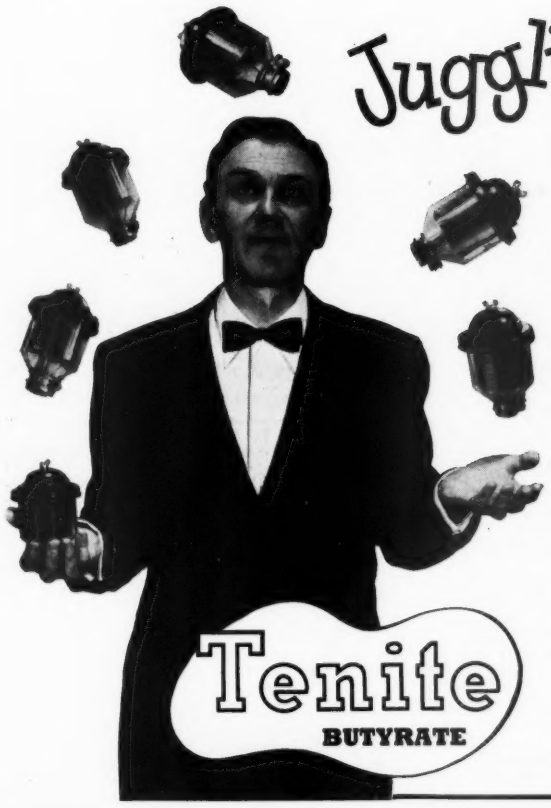

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Last-minute additions and deletions are accepted by telephone from trade advertisers up to noon. Advertisements received too late for a particular issue are automatically inserted in the succeeding one unless instructions to the contrary are received.

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HEAD OFFICES.—Bowling Green Lane, London, E.C.1, England. Telephone: Terminus 3636. Telegrams: "Pressimus, London Telex," Telex: 23839.

BRANCH OFFICES: Bayliss House, Hurst Street, Birmingham, 5. Telephone: Midland 6616. 50, Hertford Street, Coventry. Telephone: Coventry 62464. 1, Brazennose Street, Manchester. Telephone: Deansgate 6114-8. 12, Renfield Street, Glasgow. Telephone: Glasgow Central 1413.

AGENCIES

SOUTH AFRICA. Rhodesias. Technical Sales Representation plastics, raw materials, finished goods, machinery. Lewis, P.O. Box 27, Seapoint, Cape. 240-x9722

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ESTABLISHED 1855.
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SILK SCREENING ON POLYTHENE. Large user wishes to create own department and requires technical assistance. All proposals treated in strict confidence. Reply to Box 7497, Frost-Smith Advg., 64 Finsbury Pavement, London, E.C.2. 240-31

PLASTIC TOY MANUFACTURERS. As part of an estate, this bank holds U.S. patents to a toy vehicle and launching device therefor. Will sell or license. Direct inquiries to The Harter Bank and Trust Company, Trust Department, Canton, Ohio, U.S.A. 244-5465

POLYTHENE BAGS WANTED. Overseas manufacturer commencing production in the United Kingdom requires Polythene Bags for packing finished products, initial requirement £25,000 per annum wishes to contact two or three layflat film convertors with a view to arranging permanent contracts. Smaller manufacturers giving personal service preferred. Box P391, care of "Plastics." 240-5469

ADVERTISER with own business (not Plastics) requires advice from anyone with sound knowledge of Plastics, particularly welding p.v.c. Any proposition considered. Partnership, or as technical adviser, etc. Box P3922, care of "Plastics." 240-x9905

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W. BRUCE BROWN, F.R.S.A., M.S.I.A., designer specializing in the development of new plastic articles. 140, Roding Rd., Loughton, Essex. Tel. Loughton 4138. 241-5467

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MACHINERY, TOOLS AND PLANT

36 in. × 23½ in./18½ in. Cracker (fluted rolls) by Francis Shaw, 36 in. × 12 in., two 40 in. × 12 in., and 36 in. × 16 in. Rubber Mills, three in line, 1 no motor or drive. 54 in. × 20 in. Iddon 4-Roll Calender, with 90/30 h.p. variable drive. 30 in. × 12 in./10 in. 4-Roll Calender by Bridge, with 30/10 h.p. variable drive. 2 in. David Bridge Extruder, with motor drive. Two 24 in. × 24 in. Multi-Platen Hydraulic Presses. One 28 in. × 28 in. John Shaw Multi-Platen Press, 26 in. ram. Two Vertical Jacketed Vulcanising Pans, 4 ft. dia. × 8 ft. 6 in. deep. Two Horizontal Vulcanisers, 5 ft. 10 in. dia. × 30 ft. long. 100 lb. p.s.i.

Further details, prices, and appointments to view from:

HODSON & CO. (MACHINERY), LTD.
SPRING MILLS,
TOTTINGTON.
NR. BURY, LANCS.
Phone, Tott 123/4 240-24

8/10 OZ. INJECTION MOULDER, quantity moulds, including brush moulds, Polystyrene, Diacon and other materials, Electric Oven, G.E.C., Infra-Red Reflector Oven and other equipment, details from Box P4023, care of "Plastics." 240-23

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Daniels No. 2A Preforming Machine. Capacity 1¼" diam. × ¾" depth.

Edgwick Type A1611 Cold Chamber Diecasting Machine. Hydraulic operation. Capacity 1¼ lbs. (Aluminium.)

Edgwick "Hy" Fully-Automatic Injection Moulding Machine. Capacity 1½ ozs.

Alfred Herbert Ltd., P.O. Box No. 18, Red Lane Works, Coventry. 240-34

One only. 7-gallon 3-throw Bradley & Turton Pump complete with Motor, starter and guards.

Two only. 100-ton Bradley & Turton Upstroking Presses with gas platens.

One only. 25-ton Vertical Injection Press complete with push backs and guards.

Two only. 15-ton Vertical Injection presses with push back rams.

One only. 15-ton Thompson Upstroking Compression Press with gas platens.

One only. 10-ton Bradley & Turton Upstroking Compression Press with gas platens.

Two only. Gas Pre-heaters.

Box P.394, care of "Plastics." 240-40

HYDRAULIC. Frazer mono-radial pumps, new and secondhand, in stock. Thompson & Son (Millwall), Ltd., Cuba Street, London, E.14. East 1844. zzz-119

RECONDITIONED MIXERS for ALL PURPOSES: Cake Mixers from 10-80-quart capacity, and Dough Kneaders from ½ to 1½-sack capacity. Each machine carefully overhauled and guaranteed—let us send you details. Sorensen Bakery Equipment Limited, 42, Raby St., Moss Side, Manchester, 16. Phone, Moss Side 2054/4054. Grams, Rahbek. 240-5438

VERTICAL FOUR ROLL CALENDER, 54" wide rolls, 20" dia., by Iddon Brothers Ltd. Completely modernized unit in excellent condition, fitted electrical roll adjustment, even and friction drive 1:1.9, steam heated and water cooled, driven by modern 90/30 H.P. Variable Speed Motor, B.T.H., 1,000/300 r.p.m. through Reduction Gear 1,000/73 r.p.m. Calender fitted with chain driven chalking and batching-off equipment including 12⅜" dia. 53" wide drum, 24" dia. 52½" wide drum. Suitable for profiling. Reasonable offer accepted. Box P4011, care of "Plastics." 240-1

Machinery, Tools and Plant (contd.)

4,000-ton Upstroke Press by John Shaw. Ram 41 in. diam. × 21 in. stroke. W.P. 3 tons sq. in., 4 screwed columns 16½ in. diam. with distances 60 in. × 23½ in. Daylight table and press head 24 in. Operated by 4-column Intensifier and 70 h.p. Hele-Shaw Variable delivery Hydr. Pump. Motorized 400/3/50.

Five 1,160-ton Upstroke Presses by Robertson & Orcher. Glanded ram 33½ in. diam. × 15 in. stroke. Four columns 8 in. diam., distance between 7 ft. 1 in. × 17 in. Semi-guided moving table and head with working area 6 ft. 5 in. × 4 ft. Daylight 13½ in. W.P. 3,000 lb. sq. in. Fitted 2 C.I. Platens 6 ft. 5 in. × 4 ft. × 4½ in.

Two 550-ton Upstroke Presses by John Shaw. Ram 17½ in. diam × 4 ft. 6 in. stroke. Four 7 in. diam. columns distances 72½ in. × 20 in. Fully guided moving table, working space 72 in. × 44 in. Daylight adjustable up to 78 in. W.P. 2½ ton. sq. in. Presses could be adapted as Downstroking unit.

Six 400-ton Upstroke Presses by Greenwood & Batley. Glanded Ram 16 in. diam × 30 in. stroke. Four steel columns 5½ in. diam., distances between 22 in × 17½ in. Fully guided moving table, working area 31½ in. × 22 in. Daylight 42 in. W.P. 2 ton sq. in.

Three 400-ton Upstroke Presses by Greenwood & Batley. Glanded ram 16 in. diam. × 30 in. stroke. Four screwed columns 5½ in. diam., distances between 22 in. × 17½ in. Moving table, working area 3 ft. × 17 in. Daylight 42 in. W.P. 2 ton sq. in.

350-ton Upstroke Press by Bradley & Turton. Ram 15½ in. diam. × 24 in. stroke. W.P. 2 ton sq. in. Four steel columns 4½ in. diam., distances between 42¼ in. × 15½ in. Fully guided moving table, working area 39½ in. × 37 in. Daylight 33 in. Moving table returned by 2 pushback rams 4 in. diam. W.P. 1,500 lb. sq. in.

250-ton Upstroke Press. Ram 18 in. diam. × 15 in. stroke. W.P. 1 ton sq. in. Four columns 5⅛ in. diam., distance between 22½ in. × 18 in. Semi-guided tee-slotted table 30 in. × 14 in. × 9¾ in. deep., daylight 14½ in.

200-ton Downstroke Press by John Shaw. Ram 20 in. diam. × 24 in. stroke. W.P. 1,500 lb. sq. in. Four columns 4⅛ in. diam., distances between 26½ in., 10½ in. Fully-guided moving table, working area 26 in sq.

200-ton Downstroke Compression and for Transfer Moulding Press. Double-acting piston type main ram with effective area 11 in. diam. × 12 in. stroke. Fixed and moving tables with working area 30 in. × 21 in. Daylight 36 in. Double acting piston type ram 6½ in. diam. × 8 in. stroke. Fitted hydraulically op. Ejector Crosshead.

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WOOD LAND, LONDON, W.12.
Phone, Shepherds Bush 2070
AND
STANNINGLEY, NR. LEEDS.
Phone, Pudsey 2241. 240-5475

FOR SALE—Reed-Prentice 10D8 Injection Moulding Machine under two years old, little used, being unwanted capacity. Inspection invited; offers to Mr. C. H. Vessey, works manager, Resinoid & Mica Products, Ltd., Mary St., Balsall Heath, Birmingham 12. 240-13

5" POLYTHENE STRIP EXTRUDER by David Bridge, including 48" slot die for spreading, in full working order. Oil heated jacket, electrically heated nose. Multi-point pyrometer for slot die. Automatic cold feed vibrator. 45 to 6.5 variable speed motor 400/3/50—1,700 to 240 r.p.m. Whole on steel support framing. Original cost £6,400 in 1952. Phone: Greenwich 3291, Extn. 26. 240-15

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Machinery, Tools and Plant (contd.)

PLASTICS MACHINERY
Hydraulic Presses of all sizes. Injection Machines. Extruders. Mixing Mills. Hydraulic Pumps and Accumulators.

Send your requirements to the specialists.
REED BROTHERS (ENGINEERING), LTD.,
REPLANT WORKS,
CUBA STREET, MILWALL, E.14.
Phone, East 4081 (five lines). 240-35

¾ oz. FRANCIS SHAW HAND OPERATED INJECTION MOULDER with Heat Controller and Die Lock. In good working condition £120. " Cordway " Ltd., 73, St. Saviours Rd., Leicester. Phone 23342. 240-19

ONE REED-PRENTICE 4 oz. Injection Moulding Machine Serial No. 5A/D13/F2588/49 for sale. First class condition: can be seen working at Portsmouth. Apply to Box P402, care of " Plastics." 241-5495

MACHINERY, TOOLS AND PLANT WANTED

INJECTION MOULDING MACHINES required. Condition or size not important. Send details Box P3631, care of " Plastics." 241-5391

EXTRUDER and Vacuum Forming Machines wanted. Send full details. Box P3810, care of " Plastics." 222-145

INJECTION MOULDING MACHINE 1½ oz. Edgwick H.Y. or similar. Box P407, care of " Plastics." 240-7

WINDSOR R.C.100, MK.II Plastics Extruder required, must be in first class mechanical condition. Box P401, care of " Plastics." 240-12

WANTED—P.V.C. Spreading Machine—state condition and where can be inspected. B. & J. Wright & Sons Succrs., Buslingthorpe Lane, Leeds, 7. 240-18

MOULDS

WHAT YOU WANT WE CAN SUPPLY. First-class craftsmanship, reasonable prices, prompt delivery. Extrusion heads, moulds or any machining to your requirements. Write or phone Stotfold 316. Metals & Plastics Eng. Ltd., 2 Baldock Rd., Stotfold, Beds. 240-x691

YOUR DESIGN
OUR DESIGN
MOULDS TO YOUR SATISFACTION
AND OURS.
PRECONOMY CO. LTD., TOOLMAKERS.
Eastfield side, Sutton-in-Ashfield, Notts. zzz-146

COMPRESSION MOULDS for sale. Production of Household Articles, Smokers' Sundries, Fancy Goods etc. Box P389, care of " Plastics." 243-5440

MOULDS WANTED

MOULDS WANTED. Send details of your surplus or redundant Injection and Compression Moulds. Box P384, care of " Plastics." 243-5439

LAVATORY SEAT MOULD urgently required. Please send full particulars. Box P406, care of " Plastics." 240-8

PRODUCTION CAPACITY AVAILABLE

PLASTIC " FEET " wanted. Spherical or egg-shaped about ⅛" dia. with ¼" hole for use as feet for a wire product. Please send samples and quotation to Box P4022, care of " Plastics." 240-21

16-32 OZ. IMMEDIATE INJECTION MOULDING CAPACITY available. Also 2 oz.–8 oz. Contact Mr. Henry Freeman, Spa Plastics, Chesham 81200. 240-25

IMMEDIATE Injection Moulding Capacity Available, ½ oz. machines, no tool charges for runs of 100,000. Glastics, 69A Shakespeare Street, Southport, Lancs. 241-5466

CAPACITY OFFERED. Firm with large production orders on hand now has machining, fabrication and assembly capacity available in its tool-room and prototype shops and is able to undertake work of this nature immediately. At present approximately 1,000 hours per week are available, including jig-boring. Limits to A.I.D., A.R.B. or Commercial requirements. Please write to Box P3910, care of " Plastics." 240-5473

REPETITION in Ebonite, Erinoid, etc. Capstan lathe work. Temple St., Rugby. Phone 4059. 247-5388

INJECTION MOULDINGS by I.O.G. Industries, Ltd., 41 Marshgate Lane, Stratford, E.15. Maryland 2804. 244-5276

SHORT RUNS A SPECIALITY, LONG RUNS A PLEASURE. Low mould cost and overheads. Injection capacity and technical knowledge at your service. Westminster Plastics, Temple Works, 41 Old Church Rd., Chingford, E.4. Silverthorn 7927. 247-5387

Production Capacity Available (contd.)

NYLON, POLYSTYRENE AND ACETATE INJECTION MOULDINGS up to 2 oz. Reliable service. Latest-type machines. Keen co-operation on new lines. W. H. Adamson Plastics, Ltd., 39 Hedley St., Maidstone. 244-5468

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THE LEADING CRAFTSMEN IN
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PROTOTYPE AND REPETITION.
OFFICIAL I.C.I. STOCKISTS " PERSPEX."
SHEET, TUBE, ROD.
STOCKISTS AND FABRICATORS OF " FORMICA."
149 LONDON ROAD, CROYDON, SURREY.
Phone, Croydon 8228 (two lines) zzz-133

INJECTION MOULDING CAPACITY. Considerable tool-cost savings based on 23 years' experience. Design advice. Martin's Products Limited, 91–92 Turnmill St., E.C.1. Clerkenwell 6070. 242-5416

VACUUM FORMED PLASTICS. Facilities for design development, fabricating and printing. B. T. Bennett & Co., 449 Alexandra Avenue, Harrow, Middx. Field End 6755. 248-5475

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PLASTICS (MANCHESTER), LIMITED,
BRITAIN'S LEADING STOCKISTS
OF
PERSPEX SHEET, ROD, RUBE,
11 WHITWORTH STREET,
MANCHESTER, 1.
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CUEX LTD., can offer all at prices well below current list:—
Polystyrene.
Cellulose acetate.
Polyethylene.
P.V.C.
Polyvinyl butyral.
Perspex and Diakon.
Send now for details.
Cuex Ltd., 270 Corporation St., Birmingham. Central 5447. 240-37

FOR DISPOSAL: 2 tons Virgin Khaki and 3 tons Virgin Maroon Polystyrene Pellets. Apply Box P2613, care of " Plastics." 240-36

ALWAYS LARGE STOCKS OF
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RODS, TUBES AND SHEETS.
PERSPEX
SHEETS UP TO 1 IN. THICK.
CELLULOSE ACETATE
CATALIN RODS.
S.R. (PLASTICS), LTD.,
93 ALDERSGATE STREET, E.C.1.
Phone, Monarch 4686. 245-5323

FOR DISPOSAL—Approximately 2½ cwt. Clean P.T.F.E. Turnings, machined scrap, etc., also approximately 3½ cwt. Polythene mixed scrap. Samples available. Apply Box P403, care of " Plastics." 240-11

P.V.C. GRANULATED SCRAP. Sorted in Black and Grey. 40 tons monthly available. Prompt shipment from Western Germany. Attractive price. Box P4013, care of " Plastics." 240-x421

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WE REQUIRE large regular supplies of Nylon Scrap, Shavings, Lumps and Rejects. Box P332, care of " Plastics." 240-39

THERMOPLASTICS SCRAP. We always buy large and small quantities and pay prompt Cash. Send offers to J. W. Nash & Co. Ltd., 27 Beethoven St., W.10. Ladbroke 4655/6/7. 240-38

WANTED all types of Polythene Scrap. Send details and samples to: Tyruplex, Ltd., 111 High St., N.W.10. Elgar 2684. 240-41

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ERLANOS, LTD., 93 Aldersgate St., E.C. (Monarch 4686), require Perspex and cellulose offcuts and scrap, clear and coloured; highest prices paid. 241-5177

WANTED, Polythene scrap. Write to Box P221, care of " Plastics." zzz-132

SPOT CASH BUYERS of all thermoplastic injection scrap and redundant virgin lots. Regular collections. WG Plastics, 14 Cambridge Park Mews, Twickenham, Middlesex. Popesgrove 1800. 246-5352

WANTED.—Acetate Sheet offcuts, size .005. Clear and Black. Novelties Unlimited, 395 Hornsey Rd., London, N.19. 240-5437

POLYETHYLENE MOULDING POWDERS, lay-flat tubing and scrap of all kinds wanted against prompt cash payment. Box P398, care of " Plastics." zzz-147

Raw Material Wanted (contd.)

BROCKWELL PLASTICS LTD., 50 Hollingbourne Rd., S.E.24, will purchase redundant polyethylene scrap of all kinds. We collect and pay cash on collection. Box P399, care of " Plastics." zzz-148

POLYTHENE SCRAP: top prices paid for any form of polythene scrap. Send offers and samples to Herbert Connor Ltd., 120, Beaufort Park, London, N.W.11. 240-4

HERBERT CONNOR LTD.: Buyers of all plastic scrap—top prices paid on any terms for Polythene, Polystyrene, Perspex, Diakon, Acetate, P.V.C. in any form: lump, film, scrap, offcuts, and reground. Send details and samples to 120, Beaufort Park, London, N.W.11. 240-3

POLYTHENE WASTE AND OFFCUTS—top prices paid. Box P4010, care of " Plastics." 240-2

WANTED
REGULAR SUPPLIES POLYTHENE SCRAP
TOP PRICES PAID
CONTRACTS DIRECT WITH COMPOUNDER
NO INTERMEDIARY
PAYMENT PROMPT
APPLY BOX P409, CARE OF " PLASTICS "
240-5

ALL GRADES of nylon scrap required. Box P408, care of " Plastics." 240-6

SITUATIONS VACANT

British Belting & Asbestos Ltd., have the following vacancies in their Research Laboratories.

(*a*) **CHEMIST or TECHNOLOGIST** for Research and Development work in the field of Glass Fibre and Asbestos Plastics. A four-figure salary is envisaged and the prospects are excellent.

(*b*) **CONTROL CHEMIST** to take charge of staff engaged in Raw Material Analysis and Works Control in the production of Brake Lining, Belting and Asbestos, Rubber and Plastics products. Experience in control work desirable. The post will carry a four-figure salary and further prospects are good.

Application should be made to Personnel Department, British Belting & Asbestos Ltd., Scandinavia Mills, Cleckheaton, Yorkshire. 240-33

A SMALL BUT VIRILE COMPANY engaged in novel and interesting field of plastic moulding in S.W. London requires the services of an intelligent and hard working young man. The primary requisites are strength of character coupled with capacity for acquiring knowledge. General education, technical background, experience of production methods and control will be taken into account in judging applications. The ability of the applicant will determine his own rate and level of advancement which can reach high executive responsibility. Please apply by letter giving full details of past and present including salary required to Box P4020, care of " Plastics." 240-27

MOULD SETTER with first-class, all-round experience in Injection Moulding technique and setting required by modern and progressive Plastic Manufacturers, Croydon area. Good Salary. Write giving full details to Box P4019, care of " Plastics." 240-28

PLASTICS PRODUCTION MANAGER required by custom moulders in reinforced plastics at present mainly occupied in manufacturing safety helmets. Contemplating new lines. Applicants must give details of technical qualifications and experience in reinforced plastics. State present salary. Write Box P4017, care of " Plastics." 240-30

EXPERIENCED Glass Reinforced Laminate Technicians required. Excellent prospects and pension schemes. Apply to Thermo Plastics Ltd., Dunstable, Beds. 240-26

YOUNG ENGINEER with sound knowledge of Plastic materials and extrusion techniques required for development work in a large and expanding concern. The post will call for initiative and inventive imagination. Apply confidentially giving details of experience and salary required to Box P4018, care of " Plastics." 240-29

INJECTION MOULDING CHARGE HAND required experienced in tool setting and capable of taking charge of 14 machines 2 to 24 oz. capacity. Alternate night–day shifts. Free Insurance contributary pension scheme in operation. South Buckinghamshire district. Housing assistance may be available. Write full particulars. Box P4021, care of " Plastics." 240-22

WORKS MANAGER required for small trade tool-room near London. Experience Plastic Moulds essential. Strict disciplinarian. Send full details. Box P395, care of " Plastics." 241-5470

FOREMAN MOULDER required. Small shop near London. Essential fully experienced. Write Box P396, care of " Plastics." 241-5471

TOOL ROOM FOREMAN (working) required. Experience moulds essential. Capable supervisor. Near London. Permanent and progressive position. Write Box P392, care of " Plastics." 241-5472

TOOLMAKER REQUIRED. Experience moulds essential. Permanent and high rate. Seaforth, 60 Oakhurst Rd., Southend, Essex. 242-5417

Situations Vacant (contd.)

DESIGNER-DRAUGHTSMAN required. Experience Injection and Compression Moulds essential. Near London. Details experience and salary Box P388, care of "Plastics." 243-5441

JOHNSON, MATTHEY & CO., LIMITED
REQUIRE A CHEMIST
of Degree Standard at their
Research Laboratories at Wembley,
Middlesex.
THE WORK WILL BE ON PRODUCTS
CONTAINING ORGANO-METALLIC
COMPOUNDS
and some experience
in Resin and Solvent Technology
would be useful.
CANDIDATES SHOULD APPLY,
GIVING DETAILS OF AGE,
QUALIFICATIONS, EXPERIENCE, ETC.
TO THE COMPANY SECRETARY, AT
78 HATTON GARDEN,
LONDON, E.C.1. 240-32

GLASS REINFORCED PLASTICS. A factory manufacturing vehicles bodies and components in glass reinforced plastic requires an experienced mould maker capable of developing new projects in this material and preparing production moulds for quantity runs. Apply Mickleover Transport Limited, Whitby Ave., Park Royal, N.W.10. Phone, ELGar 6371. 240-20

CHEMIDUS PLASTICS LTD., Purley Way, Croydon (subsidiary of H. J. Enthoven & Sons Ltd.) manufacturers of rigid p.v.c. tubes require a Works Manager. Candidates must have sound engineering background and preferably experience in plastics extrusion. Age 35/45. Salary range £1,000/£1,500. Write to Secretary, H. J. Enthoven & Sons Ltd., Dominion Buildings, South Place, London, E.C.2. 240-14

PERMALI LIMITED, Gloucester require a manager for their Permaglass Department. Applicants should preferably be aged 25–35 years, have a good chemical background and experience in reinforced glass and resin products. Shop floor production experience essential. Good salary, pension scheme. Apply in writing to the Secretary, 125, Bristol Rd., Gloucester. 240-17

Situations Vacant (contd.)

WORKING FOREMAN wanted for Midland Factory engaged in the production of 3-D Badges, Vacuum Plating, Spraying etc. Plenty of scope. Pension Scheme, Modern Factory. Full details to Box P405, care of "Plastics." 240-9

FIRST CLASS QUALIFIED
DRAUGHTSMAN
Experienced in designing
Compression and Injection Moulds
REQUIRED BY FIRM OF PLASTIC MOULDERS
IN THE NORTH WEST
The position is one of responsibility
involving the control of
Development and Production.
A VERY GOOD SALARY AND A
POSSIBILITY OF JOINING THE BOARD
AT A LATER DATE
AWAITS A SUITABLE MAN.
BOX P404, CARE OF "PLASTICS"
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